Information Technology Program
Career Cluster: Information Technology

INFORMATION
TECHNOLOGY

Foundation Competencies
are based on National
Information Technology
Education Foundations

Foundation Skills
Certificates of Proficiency

Programming
Concentration
11.0201

Network
Management
Concentration
11.0901

Multi-Media
Design
Concentration
11.0801

Computer
Installation &
Repair
Concentration
47.0104
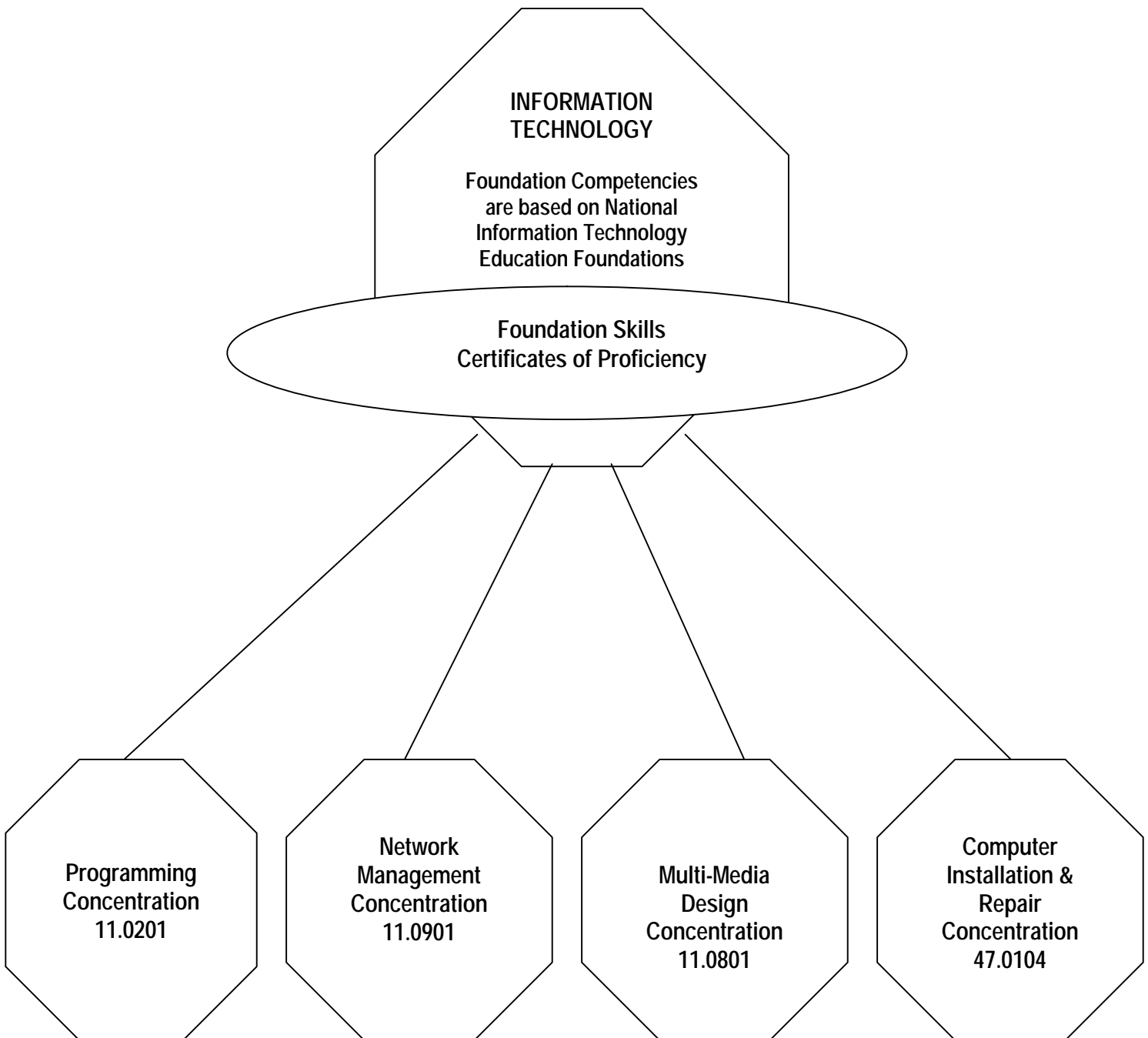
Program completion requires
meeting the Foundation
Competencies and the
competencies of at least four
modules in an area of
concentration

Program: Information Technology
Career Cluster: Information Technology
Concentration Areas:
Programming
Network Management
Multi-Media Design
Computer Installation & Repair

Program Scope and Content: To earn one-year program certificate the student must complete all core competencies PLUS the competencies of at least 4 modules of a concentration area. Concentration areas include Programming, Network Management, Multimedia, and Computer Installation & Repair.

Foundation Core Competencies - The Foundation Core Competencies are based on the National Information Technology Career Cluster foundation knowledge and skills and where in part generated from the National Skill Standards Board project carried out by the Northwest Center for Emerging Technologies. The foundation competencies are prerequisite and career sustaining levels, which provide a fundamental foundation and understanding of principles in order to be effective as an IT professional.

This industry based program, taught in Career and Technical Centers, provides students with the opportunity to apply theory based instruction through hands-on experiences such writing and testing computer programs, developing state-of-the-art web pages, establishing and managing databases, designing and building networks and network systems, repairing computer hardware and system troubleshooting. This program provides multiple pathways to post-secondary education and careers within the information technology industry including design, development, planning, and maintenance of information technology products and systems. A national effort is underway to establish skill standards for this industry that offers opportunities not only for entry level and part-time workers, but also for full-time employees to move upward into management. Career and technical training programs will provide a career ladder approach. More details on instructional methods and strategies (including work-based experiences) follow:

<u>Links with Industry and Industry Certifications</u>
Computer Programming Certificate Title: Programming Scenario Assessments. Starting in 2002, a series of programming assessments were developed in cooperation with IBM, IDX, and National Life Corporation through Barre Technical Center. These assessments are being pilot tested in the spring of 2003. The assessments are based on a real life situation designed to address the appropriate level of instruction. The assessments use the national career cluster protocol for assessment and certification and include technical, academic and workplace skills and knowledge.

Network Management Certificate Title: Cisco Certified Design Associate. The CCDA certification (Cisco Certified Design Associate) indicates a foundation or apprentice knowledge of network design for the Cisco Internetwork Infrastructure. CCDA certified professionals can design routed and switched network infrastructures involving LAN, WAN, and dial access services for businesses and organizations. For more information go to http://www.cisco.com/en/US/learning/le3/le11/learning_about_registering_for_exams.html or http://www.cisco.com/en/US/learning/le3/le2/le0/le4/learning_certification_type_home.html

Another certification available to Network Management programs is the **Cisco Certified Network Associate.** The CCNA certification (Cisco Certified Network Associate) indicates a foundation in and apprentice knowledge of networking. CCNA certified professionals can install, configure, and operate LAN, WAN, and dial access services for small networks (100 nodes or fewer), including but not limited to use of these protocols: IP, IGRP, Serial, Frame Relay, IP RIP, VLANs, RIP, Ethernet, Access Lists. More information can be obtained at
http://www.cisco.com/en/US/learning/le3/le11/learning_about_registering_for_exams.html or
http://www.cisco.com/en/US/learning/le3/le2/le0/le4/learning_certification_type_home.html
Also, a consortium of IT business known as Comptia offers a certification in the technical components of networking administration and support. **CompTIA Network+ Certification** is the worldwide standard of competency for professionals with nine months experience in network support or administration. The Network+ certification validates technical competency in networking administration and support. Those

holding Network+ certification demonstrate critical knowledge of media and topologies, protocols and standards, network implementation and network support. This certification is geared toward those with nine months field experience in network administration and support although may be applied upon completion of a career and technical center program. More information is available at
http://www.comptia.org/certification/network/default.asp

MultiMedia Design Certificate Title: CompTIA i-Net+. The CompTIA i-Net+ certification is the worldwide standard of foundational-level competency in knowledge of Internet, Intranet and Extranet technologies. The i-Net+ certification is recognized as a baseline technical knowledge specifically designed to certify entry-level Internet and e-commerce technical professionals. Those holding i-Net+ certification demonstrate knowledge and competency in Internet basics and clients, development, networking, Internet security and business concepts. More information is available at http://www.comptia.org/certification/i-net/default.asp

Computer Installation & Repair Certificate Title: CompTIA A+ Certification. The CompTIA A+ certification is the industry standard for validating vendor-neutral skills expected of an entry-level computer technician. Those holding the A+ certification have a broad base of knowledge and competency in core hardware and operating system technologies including installation, configuration, diagnosing, preventive maintenance and basic networking. For more information go to
http://www.comptia.org/certification/a/default.asp

In addition, Information Support and Maintenance program participants may be eligible for the **CompTIA i-Net+** certification which again, is recognized as a baseline technical knowledge specifically designed to certify entry-level Internet and e-commerce technical professionals. Those holding i-Net+ certification demonstrate knowledge and competency in Internet basics and clients, development, networking, Internet security and business concepts.

More information is available at http://www.comptia.org/certification/i-net/default.asp

Occupational Information and Outlook:
Information Technology includes the obvious firms such as those directly involved in software development, networking, hardware installation/maintenance, and information processing but also IT dependent jobs in other sectors including manufacturing, health care, banking, insurance, retailing, construction, travel/tourism, and others. Thus, unlike our traditional concept of an economic sector, the "IT Sector" is in fact an occupational area with a skill set that has a high degree of utility and adaptability to a wide range of work environments. Improving the IT skills of our workforce will have beneficial effects not limited to firms in the IT business. Workers with these skills will have an increasingly wide range of workplaces in which to apply their expertise. The following is information from the Bureau of Labor and Statistics:

Computer Hardware Engineers - The number of computer hardware engineers is relatively small compared with the number of other computer-related workers who work with software or computer applications. About 25 percent have been employed in computer and data processing services.
Computer hardware engineers are expected to have favorable job opportunities. Employment of computer hardware engineers is projected to increase faster than the average for all occupations through 2010, reflecting rapid employment growth in the computer and office equipment industry, which employs the greatest number of computer engineers.

Median annual earnings of computer hardware engineers were $67,300 in 2000. Median annual earnings in the industries employing the largest numbers of computer hardware engineers in 2000 were: Computer and office equipment at $75,730, Computer and data processing services at 69,490, Electronic components and accessories at 67,800, Telephone communication at 59,160.   Starting salaries for computer engineers with a bachelor's degree can be significantly higher than salaries of bachelor's degree graduates in many other fields.

Computer Programmers - Programmers are employed in almost every industry, but the largest concentration is in the computer and data processing services industry, which includes firms that write and sell software.

Employment of programmers is expected to grow about as fast as the average for all occupations through 2010. Jobs for both systems and applications programmers should be most plentiful in data processing service firms, software houses, and computer consulting businesses.

Employment of programmers, however, is expected to grow much slower than that of other computer specialists. As the level of technological innovation and sophistication increases, programmers should continue to face increasing competition from programming businesses overseas where much routine work can be contracted out at a lower cost. Nevertheless, employers will continue to need programmers who have strong technical skills and who understand an employer's business and its programming needs.

Median annual earnings of computer programmers were $57,590 in 2000. Median annual earnings in the industries employing the largest numbers of computer programmers in 2000 were: Personnel supply services at $65,780, Professional and commercial equipment at 63,780, Computer and data processing services at 61,010, Commercial banks at 60,180, and Management and public relations at 57,120.

Computer Software Engineers - Although they are employed in most industries, the largest concentration of computer software engineers, almost 46 percent, is in the computer and data processing services industry. This industry includes firms that develop and produce prepackaged software and firms that provide contractual computer services such as computer programming, systems integration, and information retrieval, including online databases and Internet services.

Computer software engineers are projected to be the fastest growing occupation from 2000 to 2010. Very rapid employment growth in the computer and data processing services industry, which employs the greatest numbers of computer software engineers, should result in very favorable opportunities for those college graduates with at least a bachelor's degree in computer engineering or computer science and practical experience working with computers. Employers will continue to seek computer professionals with strong programming, systems analysis, interpersonal, and business skills.

Median annual earnings of computer software engineers, applications, who worked full time in 2000 were about $67,670. Median annual earnings in the industries employing the largest numbers of computer applications software engineers in 2000 were: Computer and office equipment at $74,300, Computer and data processing services at 69,520, Engineering and architectural services at 68,790, Professional and commercial equipment at 64,920, and Management and public relations at 62,660.

Computer Support Specialists and Systems Administrators – Computer support specialists and systems administrators held about 734,000 jobs nationally in 2000. Of these, about 506,000 were computer support specialists and about 229,000 were network and computer systems administrators. Although they worked in a wide range of industries, about one-third of all computer support specialists and systems administrators were employed in business services industries, principally computer and data processing services.

Computer support specialists and systems administrators are projected to be among the fastest growing occupations over the 2000-10 period. Employment is expected to increase much faster than the average for all occupations as organizations continue to adopt and integrate and data processing services, which is projected to be the fastest growing industry in the U.S. economy. Demand for computer support specialists is expected to increase because of the rapid pace of improved technology. As computers and software become more complex, support specialists will be needed to provide technical assistance to customers and other users. Demand for systems administrators will grow as a result of the upsurge in electronic commerce and as computer applications continue to expand. Companies are looking for workers knowledgeable in the function and administration of networks.

Due to the rapid growth in demand for computer support specialists and systems administrators, those who have strong computer skills but do not have a bachelor's degree should continue to qualify for some entry-level positions. However, certifications and practical experience are essential for persons without degrees.

Median annual earnings of computer support specialists were $36,460 in 2000. Median annual earnings in the industries employing the largest numbers of computer support specialists in 2000 were: Professional and commercial equipment at $42,970, Computer and data processing services at 37,860, Personnel

supply services at 34,080, Colleges and universities at 32,830, and Miscellaneous business services at 21,070. Median annual earnings of network and computer systems administrators were $51,280 in 2000. Median annual earnings in the industries employing the largest number of network and computer systems administrators in 2000 were: Professional and commercial equipment at $42,970, Computer and data processing services at 37,860, Personnel supply services at 34,080, Colleges and universities at 32,830, and Miscellaneous business services at 21,070.

Systems Analysts, Computer Scientists, and Database Administrators

Systems analysts, computer scientists, and database administrators held about 887,000 jobs in 2000. Although they are increasingly employed in every sector of the economy, the greatest concentration of these workers is in the computer and data processing services industry.

Systems analysts, computers scientists, and database administrators are expected to be among the fastest growing occupations through 2010. Employment of these computer specialists is expected to increase much faster than the average for all occupations as organizations continue to adopt and integrate increasingly sophisticated technologies.

Median annual earnings of computer systems analysts were $59,330 in 2000. Median annual earnings in the industries employing the largest numbers of computer systems analysts in 2000 were: Computer and data processing services at $64,110, Professional and commercial equipment at 63,530, Federal Government at 59,470, Local Government at 52,490, and State Government at 51,230. Median annual earnings of database administrators were $51,990 in 2000. Median annual earnings of network systems and data communication analysts were $54,510 in 2000. Median annual earnings of computer and information scientists, research, were $70,590 in 2000. According to Robert Half International, starting salaries in 2001 ranged from $72,500 to $105,750 for database administrators. Salaries for Internet-related occupations ranged from $58,000 to $82,500 for webmasters and $56,250 to $76,750 for Internet/Intranet developers.

The Career and Technical Education Information Technology programs provide for well-rounded training in the IT area with broad-based career training opportunities and clear career paths in each of the three concentration areas. Industry representatives (see below) tell of the importance of cross training in the IT industry to broaden career horizons and keep trained employees thriving in the business for the long-term. Broad-based training provides the best opportunity for advancement of those choosing IT as a career.

➤ Effective professionals have strong, life long learning foundation skills;
➤ Having broad foundational skills prepare individuals for careers as well as jobs;
➤ Narrowly defined training nominally prepares individuals for a job, however, without broad foundation skills, not a career—in some cases, results in almost immediate obsolete skills;
➤ Need life long learners who can easily adapt to persistent technical, job and market changes;
➤ Series of skill assessments and credentials need to be articulated along educational process;
➤ Model education of professionals along education to become a doctor, i.e., broad based foundational knowledge becoming more focused during undergraduate education;
➤ Changes (technology, organizational and market) occur so rapidly that traditional static education and training systems are minimally effective, minimal return on investment;
➤ Scenario assessments, if properly administered, can measure foundation and technical survey skills and knowledge along education process beginning in 8th grade – i.e., Programming Pilot Assessment;
➤ There is concern that traditional vocational-technical education programs prepare students for jobs that will be obsolete in the immediate future as opposed to producer oriented foundational skills that are more marketable;
➤ Education should find ways to include professionals in classroom on a consistent basis;
➤ Traditional technical training process used by education and registered apprenticeship programs is not applicable for developing professionals. Need new paradigm model;
➤ Use multi-delivery educational processes to include web based programs and interactive video;

- ➢ Graduates of vocational-technical center programs should have portfolio to include performance-based assessments demonstrating proficiency of all foundation skills as a minimum as well as an entry level technical concentration;
- ➢ 10th graders by the end of the year should have a minimal level of proficiency in all foundation skills and be assessed;
- ➢ Non-company specific assessments and credentials need to be developed, valued by employers (including registered apprenticeship programs) and college programs.

In Vermont the labor market information for information technology occupations reflect the following:

Occupation	Median Annual Wages	Projected Annual Growth
Programmers	$51,000	1.4%
Software Engineers	$70,000	2.5%
Database Administrators	$49,000	3.7%
Network Admin Comp. Systems	$44,000	4.4%
Network Admin. Data Commun.	$52,900	4.0%
Computer Analyst	$51,700	2.6%
Computer Support Specialist	$36,600	5.1%

Vermont Framework Standards:

Standards -Fields of Knowledge (Academics) and Vital Results Addressed within the *Vermont Framework of Standards and Learning Opportunities:*

Fields of Knowledge Addressed:

<u>Science, Math and Technology:</u>

7.2 – Students design and conduct a variety of their own investigations and projects.

7.3 – Students understand the nature of mathematical, scientific, and technological theory.

    7.11 – Students analyze and understand living and non-living systems as collections of interrelated parts and interconnected systems.

    7.12 – Students understand forces and motion, the properties and composition of matter, and energy sources and transformations.

7.17 – Students apply knowledge and understanding of technological systems to respond to a variety of issues.

7.18 – Students understand that people control the outputs and impacts of our expending technological activities in the areas of communication, construction, manufacturing, power and transportation, energy sources, health technology, and biotechnology.

7.19 – Students use technological/engineering processes to design solutions to problems.

Vital Results Addressed:

Communications:

    1.8 – In written reports, students organize and convey information and ideas accurately and effectively.

1.10 – In written narratives, students organize and relate a series of steps that a reader can follow.

1.13 – Students listen and respond to communications.

1.14 – Students critique what they have heard.

1.15 – Students use verbal and nonverbal skills to express themselves effectively.

1.17 – Students interpret and communicate using mathematical, scientific, and technological notation and representation.

1.18 – Students use computers, telecommunications, and other tools of technology to research, to gather information and ideas, and to represent information and ideas accurately and appropriately.

    1.19 – Students use organizational systems to obtain information from various sources.

1.20 – Students use graphs, charts, and other visual presentations to communicate data accurately and appropriately.

1.21 – Students select appropriate technologies and applications to solve problems and to communicate with an audience.

    1.22 – Students employ a variety of techniques to use simulations and to develop models.

Reasoning and Problem Solving:

2.2 – Students use reasoning strategies, knowledge, and common sense to solve complex problems related to all fields of knowledge.

2.3 – Students solve problems of increasing complexity.

2.4 – Students devise and test ways of improving the effectiveness of a system.

    2.10 – Students generate several ideas using a variety of approaches.

    2.11 – Students represent their ideas and/or the ideas of others in detailed form.

2.12 – Students modify or change their original ideas and/or the ideas of others to generate innovative solutions.

    2.13 – Students design a product, project, or service to meet an identified need.

    2.14 – Students plan and organize an activity.

Personal Development:

3.3 – Students demonstrate respect for themselves and others.

3.10 – Students perform effectively on teams that set and achieve goals, conduct investigations, solve problems, and create solutions.

3.11 – Students interact respectively with others, including those with whom they have differences.

3.12 – Students us systemic and collaborative problem-solving processes, including mediation, to negotiate and resolve conflicts.

3.13 – Students analyze their roles and responsibilities in their family, their school, and their community.

3.14 – Students demonstrate dependability, productivity, and initiative.

3.15 – Students know about various careers.

   3.16   – Students develop a plan for current and continued education and training to meet personal and career goals.

Human Diversity:

4.3 – Students demonstrate understanding of the cultural expressions that are characteristic of particular groups.

4.4 – Students demonstrate understanding of the concept of prejudice, and its effect on various groups.

Embedded Credit: Mathematics for Programming and Information Support and Maintenance; Science for Interactive Media and Network Management.

Articulation Agreements: Champlain College, Johnson State College, University of Vermont, Vermont Technical College, Community College of Vermont, Lyndon State College and Castleton State Collegeas well as connections with Registered Apprenticeship being developed.

Possible Assessments through: Career Cluster Foundation assessments in basic IT applications, communications, and employablility (VTECS 2003), Scenarios, Rubrics, Portfolios, Brainbench (www.brainbench.com), NOCTI, National States' Career Cluster Initiative, Education Development Center, Newton, MA, Vermont IT Industry Partnership (Spring 2003).

Youth Leadership: The Leadership and Teamwork Competencies may be met through **VICA, FBLA, DECA, and FCCLA** co-curricular activities

Required License: Trades and Industry-Information Technology or Information Technology in Business

RESOURCES
1. Occupational Outlook Handbook 2001-2002 US Dept. of Labor
2. O'Net Resource Center www.onetcenter.org US Dept. of Labor
3. Northwest Center for Emerging Technologies, www.nwcet.org
4. EDC, Education Development Center, Newton, MA, www.edc.org/ewit
5. National Career Cluster Initiative
6. Ohio IT Works Project
7. Vermont Department of Employment and Training
8. Comptia
9. Cisco Corporation
10. NSSB, National Skill Standards Board
11. HRIC, Human Resources Investment Council
12. VTC, Vermont Technical College
13. CCV, Community College of Vermont
14. Indiana Office of Workforce Development
15. Building Linkages Among Occupational and Academic Skill Standards (1st Career Cluster Project)
16. US Dept. of Education – Office of Vocational and Adult Education,
17. Vermont Framework of Standards and Learning Opportunities,
18. American Hotel and Lodging Association www.ahma.com
19. National Life of Vermont,
20. IDX Corporation
21. IBM Corporation

Special thanks goes to the following individuals for their special work with this project:

Scott Griggs, Barre Regional Career and Technical Center
Karen Baron, Barre Regional Career and Technical Center
Steve Briggs, Stafford Technical Center
John Martell, Stafford Technical Center
LeRoy Martelle, Hartford Career and Technology Center
Mary Hazard, Lyndon Institute
Doris Jewett, Randolph Area Vocational Center
Steve Barner, Cisco and South Burlington High School
Dave Cousins, Center of Technology, Essex
Jennifer Fribush, River Valley Technical Center
Gail Fletcher, River Valley Technical Center
Lucie deLaBruere, Vermont Institutes
Jane Donahue-Holt, Burlington Technical Center
Dan Kane, Southwest Vermont Career Development Center
Theodora Contis, Mathematics/Science Teacher, Essex High School
Robin Winters, Mathematics Teacher, Champlain Valley Union High School
Paul Noiseux, Science Teacher, Whitcomb High School
Greg Renner, Science Teacher, Oxbow High School

FOUNDATION COMPETENCIES

Occupational Skills
The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

INFORMATION TECHNOLOGY BASICS

Aligned with Vermont Standards: 1.18, 7.11, 7.17, 7.18

0 1 2 3 4

θθθθθ   A.   Demonstrate basic knowledge of the history of information technology

θθθθθ   B.   Demonstrate knowledge of the impact of information technology on society

θθθθθ   C.   Demonstrate knowledge of Health, Safety and Environmental Considerations

BASIC HARDWARE, SOFTWARE AND TROUBLESHOOTING
Aligned with Vermont Standards: 1.14, 1.18, 1.19, 2.2, 7.2, 7.3, 7.17

θθθθθ   D.   Demonstrate knowledge of the hardware components associated with information systems

θθθθθ   E.   Demonstrate knowledge of the operating systems and applications associated with information systems

θθθθθ   F.   Demonstrate Knowledge of System Operation

DATA COMMUNICATIONS AND THE INTERNET
Aligned with Vermont Standards: 1.18, 7.17, 7.18

θθθθθ   G.   Demonstrate basic knowledge of the Internet & data communications

COMMUNICATION
Aligned with Vermont Standards: 1.8, 1.10, 1.13, 1.14, 1.15, 1.17, 1.18, 1.19, 1.20, 1.21, 1.22

θθθθθ   H.   Compose reports

θθθθθ   I.   Deliver oral presentations

ETHICS AND LEGAL RESPONSIBILITIES

Aligned with Vermont Standards: 4.3, 4.4

θθθθθ   J.   Demonstrate knowledge of intellectual property rights covered by intellectual law

EMPLOYABILITY AND CAREER DEVELOPMENT

Aligned with Vermont Standards: 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16

θθθθθ   K.   Demonstrate the capacity to plan and manage careers and employment relations.

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

Information Technology Basics
Aligned with Vermont Standards: 1.18, 7.11, 7.17, 7.18

0 1 2 3 4

θθθθθ   **A.**   **Demonstrate basic knowledge of the evolution of information technology**

A.001   Demonstrate knowledge of significant advances in the development of computer hardware and software

A.002   Demonstrate knowledge of major milestones in the development of information technology

A.003   Demonstrate knowledge of major individuals and their contributions to the information technology field

A.004   Demonstrate knowledge of the speed with which computer technology has evolved (i.e., evolution time line)

θθθθθ   **B.**   **Demonstrate knowledge of the impact of information technology on society**

B.001   Demonstrate knowledge of how both PCs and larger computer systems impact people and are used in business/industry/government and other institutions

B.002   Demonstrate knowledge of the impact of computers on career pathways in business/industry (e.g., how computers have eliminated and created jobs)

B.003   Demonstrate knowledge of the impact of computers on access to information and information exchange worldwide

B.004   Demonstrate knowledge of how information technology affects the natural environment (e.g., disposal of equipment, energy use, use of natural resources)

B.005   Demonstrate knowledge of proper disposal of electronic equipment

B.006   Demonstrate knowledge of the impact of electronic waste on the environment and local populations

θθθθθ   **C.**   **Demonstrate knowledge of Health, Safety and Environmental Considerations**

C.001   Demonstrate knowledge of ergonomics and repetitive strain injuries

C.002   Demonstrate knowledge of personal safety issues when working on electrical/electronic systems

C.003   Solve safety problems using problem solving, decision making, and critical thinking strategies

C.004   Demonstrate knowledge of the psychological and health risks associated with computers, i.e., safe worksite procedures.

BASIC HARDWARE, SOFTWARE AND TROUBLESHOOTING
Aligned with Vermont Standards: 1.14, 1.18, 1.19, 2.2, 7.2, 7.3, 7.17

θθθθθ   **D.**   **Demonstrate knowledge of the hardware components associated with information systems**

D.001   Identify the three main classifications of computers (i.e., Personal, Server, and Mainframes)

D.002   Identify the elements of the information processing cycle (i.e., input, process, output, and storage)

D.003   Identify major hardware components and their functions

D.004   Identify types of computer storage devices

D.005   Demonstrate knowledge of number systems and internal data representation

D.006   Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts)

θθθθθ   **E.**   **Demonstrate knowledge of the operating systems and applications associated with information systems**

E.001   Identify hardware requirements and capabilities for a given software application (e.g., processor, memory, disk space, communications, printers, monitors)
E.002   Install given application/system software in accordance with manufacturer's procedures
E.003   Access needed help using contextual help or Internet sites
E.004   Document step-by-step installation and configuration procedures
E.005   Demonstrate knowledge of operating system architecture types
E.006   Demonstrate knowledge of the system utilities used for file management
E.007   Differentiate between files and directories
E.008   Differentiate between types of storage devices (e.g., disk, tape, CD-ROM)
E.009   Demonstrate a basic working knowledge of word processors.
E.010   Demonstrate a basic working knowledge of spreadsheets.
E.011   Demonstrate a basic working knowledge of database applications.
E.012   Demonstrate a basic working knowledge of presentation software.
E.013   Demonstrate appropriate use of the Internet.
E.014   Demonstrate knowledge of e-mail etiquette by creating e-mail messages in accordance with established business standards.
E.015   Practice a code of ethics for information systems.

θθθθθ   **F.**   **Demonstrate knowledge of System Operation**

F.001   Inspect computer and/or monitor power switches to determine if they are functioning properly.
F.002   Adjust screen controls for optimum image.
F.003   Inspect keyboard and mouse cable and pins to determine whether it is properly connected to the system
F.004   Determine if MS-DOS (or some other bootable operating system) is available to boot the system
F.005   Boot system, watching screen for visual error messages, listening for tone (beep) error messages, and noting error messages

DATA COMMUNICATIONS AND THE INTERNET
Aligned with Vermont Standards: 1.18, 7.17, 7.18

θθθθθ   **G.**   **Demonstrate basic knowledge of the Internet & data communications**

G.001   Demonstrate knowledge of how to conduct searches using electronic sources (e.g., selection of search terms)
G.002   Evaluate quality and usability of electronic information
G.003   Identify the key characteristics of the Internet
G.004   Demonstrate knowledge of the ownership/administration of the Internet
G.005   Demonstrate knowledge of accepted Internet etiquette (netiquette)
G.006   Identify current uses and applications of the Internet
G.007   Demonstrate awareness of virus protection techniques
G.008   Install/upgrade web browser
G.009   Access an array of multimedia capabilities of the World Wide Web

COMMUNICATION
Aligned with Vermont Standards: 1.8, 1.10, 1.13, 1.14, 1.15, 1.17, 1.18, 1.19, 1.20, 1.21, 1.22

θθθθθ   **H.**   **Compose reports**

H.001   Identify the appropriate type of software to present data
H.002   Evaluate audience
H.003   Gather information
H.004   Organize information and develop outline
H.005   Draft document in accordance with established standards for communication

H.006   Verify spelling, grammar, and punctuation
H.007   Verify accuracy of content
H.008   Prepare final document

θθθθθ   **I.   Deliver oral presentations**

I.001   Prepare presentation and supporting materials (e.g., handouts, transparencies, electronic slide shows)
I.002   Practice presentation
I.003   Deliver presentation incorporating both verbal and nonverbal communication skills
I.004   Obtain feedback on the effectiveness of presentation
I.005   Interpret oral, written, and nonverbal communications
I.006   Evaluate audience (e.g., specific interests, level of technical knowledge)
I.007   Determine means of communications appropriate for given situations (e.g., telephone, meeting, electronic mail, and written communication)

ETHICS AND LEGAL RESPONSIBILITIES
Aligned with Vermont Standards: 4.3, 4.4

θθθθθ   **J.   Demonstrate knowledge of intellectual property rights covered by intellectual law**

J.001   Demonstrate knowledge of the various forms of intellectual property rights (e.g., copyright, patent, trademark, trade secrets)
J.002   Demonstrate knowledge of First Amendment rights and software licensing issues
J.003   Identify the rights related to electronic imagery
J.004   Identify the liability for copyright infringement, slander and libel
J.005   Demonstrate knowledge of confidentiality issues and their liability implications
J.006   Demonstrate knowledge of the characteristics of warranties
J.007   Demonstrate knowledge of "Hacker" versus "Cracker" and the importance of personal integrity
J.008   Demonstrate knowledge of security issues and guidelines for legal usage of e-mail, contamination protection strategies for e-mail, and knowledge of e-mail etiquette
J.009   Have awareness of current and emerging laws in IT.
J.010   Demonstrate appropriate use of network resources.

EMPLOYABILITY AND CAREER DEVELOPMENT
Aligned with Vermont Standards: 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16

qqqqq   **K.   Demonstrate the capacity to plan and manage careers and employment relations.**

K.001   Explain written organizational policies, rules and procedures to help employees perform their jobs.
K.002   Identify and demonstrate positive work behaviors and personal qualities including appropriate language, worksite appearance and dress, and personal health and hygiene habits.
K.003   Identify and explore career opportunities in one or more career pathways
K.004   Develop a personal career plan to meet career goals and objectives.
K.005   Demonstrate ability to seek and apply for employment including preparing a resume, portfolio, and reference list, complete an error-free job application, and demonstrate effective job interviewing skills.
K.006   Demonstrate ability to evaluate and compare employment opportunities and accept employment
K.007   Provide examples of how IT is transforming business in various industries
K.008   Demonstrate knowledge of the relationship between lifelong learning and IT career development
K.009   Demonstrate knowledge of career development/progression patterns in the IT industry
K.010   Read technical literature to update and maintain a level of current technical knowledge.

PROGRAMMING CONCENTRATION
CIP: 11.0201

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

STRUCTURED PROGRAMMING THEORY

Aligned with Vermont Standards: 1.21, 2.2, 2.4, 7.3, 7.11, 7.12

0 1 2 3 4

θθθθθ L. Demonstrate knowledge of structured programming language concepts

PROGRAM DESIGN
Aligned with Vermont Standards: 1.21, 2.2, 2.4, 2.13, 2.14, 7.3, 7.17, 7.18

θθθθθ M. Apply the process of algorithm and structured code development

DEVELOP STRUCTURED COMPUTER PROGRAMS
Aligned with Vermont Standards: 1.13, 1.19, 1.21,1.22, 2.2, 2.4, 2.10, 2.14, 7.3, 7.17, 7.18

θθθθθ N. Develop computer programs in accordance with programming theory

ADVANCED DATA STRUCTURES

Aligned with Vermont Standards: 2.3, 2.4, 2.10, 2.11, 2.12, 2.13

θθθθθ O. Develop advanced data structures in a structured programming language

TESTING
Aligned with Vermont Standards: 1.2, 2.2, 2.3, 2.4, 2.10, 1.12, 2.13, 2.14, 7.2, 7.17, 7.19

θθθθθ P. Writing robust programs (error handlers, debugging, and testing)

DOCUMENTATION
Aligned with Vermont Standards: 1.8, 1.10, 1.13, 1.14, 1.17, 1.20, 1.21, 2.11

θθθθθ Q. Demonstrate knowledge of technical documentation associated with software development

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MAINTENANCE

Aligned with Vermont Standards: 2.2, 2.4, 2.12

qqqqq   R.   Demonstrate knowledge of software maintenance

EXPRESSION ORIENTED PROGRAMMING

Aligned with Vermont Standards: 2.13, 7.19

qqqqq   S.   Demonstrate and apply knowledge of expression oriented programming

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

STRUCTURED PROGRAMMING THEORY

Aligned with Vermont Standards: 1.21, 2.2, 2.4, 7.3, 7.11, 7.12

0 1 2 3 4

θθθθθ   **L.**   **Demonstrate knowledge of structured programming language concepts**

L.001   Demonstrate knowledge of the function and operation of compilers and interpreters
L.002   Demonstrate knowledge of the basics of structured, object-oriented, and event-driven programming
L.003   Demonstrate knowledge of current key programming languages and the environment they are used in (e.g., C, C++, Visual Basic, Java, Assembler)
L.004   Demonstrate knowledge of the information system (IS) life cycle
L.005   Demonstrate knowledge of the characteristics and uses of batch processing
L.006   Demonstrate knowledge of the characteristics and uses of interactive processing
L.007   Demonstrate knowledge of modern programming methods, such as the waterfall model, or extreme programming

PROGRAM DESIGN

Aligned with Vermont Standards: 1.21, 2.2, 2.4, 2.13, 2.14, 7.3, 7.17, 7.18

θθθθθ   **M.**   **Apply the process of algorithm and ~~structured~~ code development**

M.001   Provide an overview of problem to be solved
M.002   Break down the task into its functional components – ie the methods that will be used to solve the problem.
M.003   Design program logic using both graphical and pseudocode techniques
M.004   Describe the fundamental data types **in your plan** and their definitions
M.005   Translate data structures and program design into code in a programming language
M.006   Read algorithms developed by others
M.007   Compare and contrast various algorithmic solutions to a problem, identifying pros and cons to each
M.008   Complete a desk check of an algorithm to test its viability

DEVELOP STRUCTURED COMPUTER PROGRAMS

Aligned with Vermont Standards: 1.13, 1.19, 1.21,1.22, 2.2, 2.4, 2.10, 2.14, 7.3, 7.17, 7.18

θθθθθ   **N.**   **Develop computer programs in accordance with programming theory**

N.001   Demonstrate knowledge of a variety of keywords and commands
N.002   Save and load programs
N.003   Use compile, edit and debug features of the ~~programming language~~ compiler
N.004   Demonstrate the ability to use standard data types, constants and variables
N.005   Demonstrate an understanding and handling of string data
N.006   Design and write interactive programs and control screen Input/Output
N.007   Use appropriate error trapping
N.008   Understand and use formatting features of the language
N.009   Demonstrate knowledge of iteration
N.010   Demonstrate use of decision and selection structures
N.011   Demonstrate knowledge and use of math operators
N.012   Demonstrate knowledge and use of operator order of precedence
N.013   Demonstrate knowledge and use of relational and logical operators

N.014   Use counters and accumulators to produce summary information
N.015   Use menus and procedures/functions to control flow of complex programs
N.016   Demonstrate knowledge and use of single-dimension arrays
N.017   Demonstrate knowledge and use of two-dimension arrays
N.018   Demonstrate knowledge and use of pre-defined and user-defined functions
N.019   Demonstrate the ability to write user-defined functions
N.020   Demonstrate an understanding of parameter passing
N.021   Develop and use data files
N.022   Use sorting effectively in a program
N.023   Use searching effectively in a program
N.024   Demonstrate an understanding and use of templates
N.025   Demonstrate an understanding and use of classes

ADVANCED DATA STRUCTURES

Aligned with Vermont Standards: 2.3, 2.4, 2.10, 2.11, 2.12, 2.13

θθθθ   O.   Develop advanced data structures in a structured programming language

O.001   Demonstrate an understanding and use of linked lists
O.002   Demonstrate an understanding and use of inserting linked lists
O.003   Demonstrate an understanding and use of deleting nodes and saving linked list to storage disk.
O.004   Demonstrate an understanding and use of doubly and circularly linked lists.
O.005   Demonstrate an understanding and use of stacks
O.006   Demonstrate an understanding and use of queues
O.007   Demonstrate an understanding an use of binary trees
O.008   Demonstrate an understanding and use of hash tables
O.009   Demonstrate an understanding of recursion
O.010   Demonstrate an understanding and ability to create classes

TESTING

Aligned with Vermont Standards: 1.2, 2.2, 2.3, 2.4, 2.10, 1.12, 2.13, 2.14, 7.2, 7.17, 7.19

θθθθ   P.   Writing robust programs (error handlers, debugging, and testing)

P.001   Write programs that handle solvable run-time errors such as data entry errors and file-not-found, divide by zero, etc.
P.002   Correct syntax and lexical errors allowing programs to compile
P.003   Correct common run-time errors
P.004   Create test data and plan for checking logic and error routines
P.005   Execute program with test data
P.006   Analyze test results
P.007   Correct logic errors
P.008   Retest programs
P.009   Thoroughly test programs to make sure they follow specifications, and that all sources of possible error are handled appropriately.

DOCUMENTATION

Aligned with Vermont Standards: 1.8, 1.10, 1.13, 1.14, 1.17, 1.20, 1.21, 2.11

θθθθ   Q.   Demonstrate knowledge of technical documentation associated with software development

Q.001   Document program specifications
Q.002   Identify constraints
Q.003   Identify input and output (I/O) requirements
Q.004   Write program that include comments, tabs, white space and variable naming conventions that allow for self-documenting code.
Q.005   Write useful user documentation that describes the program and it's limitations and allows the user to run the program and resolve common problems.

MAINTENANCE

Aligned with Vermont Standards: 2.2, 2.4, 2.12

θθθθθ R. Demonstrate knowledge of software maintenance

R.001   Modify existing code to perform as specified
R.002   Design a solution
R.003   Describe how the code will be modified to meet the stated objectives
R.004   Determine where the modifications will be inserted into the existing code
R.005   Determine how the modifications will affect the remainder of the code, and plan necessary adjustments
R.006   Complete a formal desk check of the algorithm to ensure that the solution works
R.007   Develop a test plan that will be used to validate the final program
R.008   Write modifications in style of existing code
R.009   Code using coding techniques discussed above
R.010   Test and evaluate using techniques discussed above
R.011   Modify documentation to reflect modifications

EXPRESSION ORIENTED PROGRAMMING

Aligned with Vermont Standards: 2.13, 7.19

qqqqq S. Demonstrate and apply knowledge of expression oriented programming

S.001   Demonstrate ability to use an interpreter, compiler or editor
S.002   Demonstrate knowledge of basic data types (atoms and lists)
S.003   Demonstrate knowledge of basic pre-defined functions
S.004   Demonstrate ability to write user-defined functions
S.005   Demonstrate use of decision structures
S.005   Demonstrate use of recursion and iteration
S.006   Demonstrate knowledge of programming techniques
S.007   Demonstrate use of simple data structures

NETWORK MANAGEMENT CONCENTRATION
CIP: 11.0901

<div style="border">

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

</div>

INTERNET

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

0 1 2 3 4

ΘΘΘΘΘ   L.   Demonstrate advanced knowledge of the Internet (exposure)

ΘΘΘΘΘ   M.   Demonstrate knowledge of the OSI Reference Model

HARDWARE DESIGN, OPERATION, AND MAINTENANCE
Aligned with Vermont Standards: 1.14, 1.18, 1.19, 2.2, 7.2, 7.3, 7.17

ΘΘΘΘΘ   N.   Demonstrate knowledge of hardware standards

ΘΘΘΘΘ   O.   Analyze the computer site environment

ΘΘΘΘΘ   P.   Demonstrate knowledge of computer architecture and processor types

ΘΘΘΘΘ   Q.   Demonstrate a basic knowledge of connectivity devices

OPERATING SYSTEMS
Aligned with Vermont Standards: 2.13, 7.3, 7.17

ΘΘΘΘΘ   R.   Maintain security requirements

ΘΘΘΘΘ   S.   Employ computer system interfaces

NETWORKING
Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

ΘΘΘΘΘ   T.   Demonstrate knowledge of basic network classifications and topologies

ΘΘΘΘΘ   U.   Demonstrate knowledge of local-area network (LAN) trends and issues

ΘΘΘΘΘ   V.   Demonstrate knowledge of common network computing platforms

ΘΘΘΘΘ   W.   Demonstrate knowledge of LAN physical media

θθθθθ   X.   Demonstrate knowledge of network connectivity basics

θθθθθ   Y.   Demonstrate knowledge of LAN switching

NETWORK ARCHITECTURES
Aligned with Vermont Standards: 7.17

θθθθθ   Z.   Demonstrate knowledge of the basics of network architecture

θθθθθ   AA.   Demonstrate knowledge of network protocols

θθθθθ   BB.   Install basic system architectures using current Windows operating system software

WIDE-AREA NETWORKS
Aligned with Vermont Standards: 7.17

θθθθθ   CC.   Demonstrate knowledge of basic telecommunications and the interconnection of networks

θθθθθ   DD.   Demonstrate knowledge of WAN protocols

NETWORK MANAGEMENT
Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ   EE.   Perform network installation procedures

θθθθθ   FF.   Perform network operation procedures

SYSTEM INSTALLATION AND MAINTENANCE
Aligned with Vermont Standards: 1.21, 7.12, 7.17

θθθθθ   GG.   Perform system maintenance

θθθθθ   HH.   Perform software upgrades and fixes

MANAGEMENT AND SUPERVISION
Aligned with Vermont Standards: 1.13, 1.14, 1.17, 1.20, 2.2, 2.3, 2.14, 3.3, 3.10, 3.11, 3.12

θθθθθ   II.   Conduct meetings

FUNDAMENTALS OF ELECTRONICS TECHNOLOGY
Aligned with Vermont Standards: 7.11, 7.12, 7.17, 7.18, 7.19

θθθθθ   JJ.   **Distinguish between analog and digital phenomena and circuits**

θθθθθ   KK.   **Demonstrate knowledge of the basic elements of communication interfacing**

θθθθθ   LL.   **Apply troubleshooting and repair techniques to a microcomputer system**

TELECOMMUNICATIONS
Aligned with Vermont Standards: 7.11, 7.12, 7.17, 7.18, 7.19

θθθθθ   MM.   **Demonstrate knowledge of transmission line applications**

θθθθθ   NN.   **Demonstrate proficiency in working with data communications**

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

INTERNET
Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

0 1 2 3 4

θθθθθ   L.   **Demonstrate advanced knowledge of the Internet (exposure)**

L.001   Demonstrate knowledge of the Transmission Control Protocol/Internet Protocol (TCP/IP) suite (ISS, NS, PSD, IM)
L.002   Demonstrate knowledge of the Domain Name Server (DNS) (ISS, NS, PSD, IM)
L.003   Demonstrate knowledge of Simple Network Management Protocol (SNMP)
L.004   Demonstrate knowledge of Bootstrap Protocol (BOOTP) and Dynamic Host Configuration Protocol (DHCP)
L.005   Demonstrate knowledge of the Address Resolution Protocol (ARP)
L.006   Demonstrate knowledge of IP forwarding, encapsulation, and fragmentation
L.007   Demonstrate knowledge of Internet security issues (ISS, NS, PSD, IM)
L.008   Identify available Internet security systems

θθθθθ   M.   **Demonstrate knowledge of the OSI Reference Model**

M.001   Identify and describe the functions of each of the seven layers of the OSI reference model.
M.002   Describe connection-oriented network service and connectionless network service, and identify the key differences between them.
M.003   Describe data link addresses and network addresses, and identify the key differences between them.
M.004   Identify at least 3 reasons why the industry uses a layered model.
M.005   Define and explain the 5 conversion steps of data encapsulation.
M.006   Define flow control and describe the three basic methods used in networking.
M.007   List the key internetworking functions of the OSI Network layer and how they are performed in a router.

HARDWARE DESIGN, OPERATION, AND MAINTENANCE
Aligned with Vermont Standards: 1.14, 1.18, 1.19, 2.2, 7.2, 7.3, 7.17

θθθθθ   N.   **Demonstrate knowledge of hardware standards**

N.001   Identify standard-setting bodies
N.002   Identify OSI, IEEE, ISO, and ITU-T (formerly CCITT) standards
N.003   Demonstrate knowledge of the importance of conformance and use of operating system APIs (rather than direct manipulation of hardware)

θθθθθ   O.   **Analyze the computer site environment**

O.001   Identify environmental requirements, conditions, and limitations
O.002   Identify power requirements and power supplies
O.003   Identify ergonomic issues
O.004   Identify structural capacities
O.005   Identify electrical wiring codes

θθθθθ   P.   **Demonstrate knowledge of computer architecture and processor types**

P.001   Demonstrate knowledge of microcomputer architecture and processors
P.002   Compare/contrast the features of different microcomputer processors
P.003   Demonstrate knowledge of minicomputer architecture and processors
P.004   Demonstrate knowledge of mainframe architecture and processors
P.005   Identify internal box components
P.006   Compare/contrast system bus structures (e.g., ISA, EISA, MCA, PCI, USB)
P.007   Evaluate architecture alternatives

θθθθθ **Q. Demonstrate a basic knowledge of connectivity devices**

Q.001   Demonstrate knowledge of the characteristics and operation of baluns
Q.002   Demonstrate knowledge of the characteristics and operation of multiplexers, modems, CODECS, DSU
Q.003   Demonstrate knowledge of the characteristics and operation of switches, gateways, bridges, routers, brouters, and repeaters
Q.004   Demonstrate knowledge of the characteristics and operation of test equipment (e.g., protocol analyzers)

OPERATING SYSTEMS
Aligned with Vermont Standards: 2.13, 7.3, 7.17

θθθθθ **R. Maintain security requirements**

R.001   Implement security procedures in accordance with business ethics
R.002   Ensure compliance with security rules, regulations, and codes
R.003   Maximize threat reduction
R.004   Assess exposure to security issues
R.005   Implement countermeasures
R.006   Maintain confidentiality
R.007   Load virus detection and protection software
R.008   Identify sources of virus infections
R.009   Remove viruses
R.010   Report viruses in compliance with company standards
R.011   Implement backup and recovery procedures
R.012   Demonstrate knowledge of potential internal and external threats to security
R.013   Follow disaster plan
R.014   Provide for user authentication (e.g., assign passwords, access level)
R.015   Demonstrate knowledge of virus protection strategy
R.016   Document security procedures
R.017   Network Security: configure, monitor and verify standard and extended access control lists to filter IP traffic

θθθθθ **S. Employ computer system interfaces**

S.001   Define hardware-software interface issues for a computer system
S.002   Identify standards and issues related to I/O programming and design of I/O interfaces
S.003   Interface peripheral devices/controllers in the computer system (e.g., software and hardware interrupts, exceptions, Direct Memory Addressing [DMA], bus structures)
S.004   Apply concepts of privileged instructions and protected mode programming
S.005   Configure peripheral device drivers (e.g., disk, display, printer, modem, keyboard, mouse, network)
S.006   Apply advanced I/O concepts (e.g., disk caching, data compression, extended memory, magnetic disk/CD-ROM storage and formats)
S.007   Identify CPU modes of operations
S.008   Allocate disk space, nonsharable resources, and I/O devices

NETWORKING
Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **T. Demonstrate knowledge of basic network classifications and topologies**

T.001   Interpret basic networking terminology
T.002   Differentiate between LANs, MANs and WANs
T.003   Demonstrate knowledge of how to turn LANs into MANs and WANs
T.004   Identify the basic point-to-point network topologies (e.g., star, ring, tree, network, irregular)
T.005   Demonstrate knowledge of packet-switching techniques
T.006   Identify the basic broadcast topologies (e.g., star ring, bus)
T.007   Demonstrate knowledge of the characteristics of connection-oriented and connectionless networks
T.008   Identify standard high-speed networks (e.g., broadband, ISDN, SMDS, ATM, FDDI)
T.009   Identify emerging networks (e.g., ATM; ISDN; satellite nets; optic nets; integrated voice, data, and video)

θθθθθ   U.   Demonstrate knowledge of local-area network (LAN) trends and issues

U.001   Demonstrate knowledge of the reasons for installing a network
U.002   Trace the evolution of networks
U.003   Analyze current trends and developments in LANs

θθθθθ   V.   Demonstrate knowledge of common network computing platforms

V.001   Differentiate between personal computers and workstations
V.002   Identify the basic features of standard microprocessors (e.g., Intel family, RISC, Cyrix)
V.003   Identify standard memory types (e.g., RAM, ROM, PROM, EPROM, EEPROM)
V.004   Identify standard input/output devices (e.g., ISA, EISA, Micro Channel, PCI, universal serial bus, drive controllers, SCSI and SCSI 2, PCMCIA, firewire)
V.005   Identify the basic features of standard operating systems (e.g., Windows 3.1, 95, 98, 02 or latest CE, Workgroups, NT; OS/2; Macintosh OS; Solaris)
V.006   Identify the basic features of standard workstation processors
V.007   Identify standard CPU architectures for mid-range computers
V.008   Identify standard operating system software for mid-range computers
V.009   Identify basic mainframe capabilities
V.010   Identify basic mainframe attributes (e.g., size, system capacity, processor speeds, fault tolerance, security, transaction processing)
V.011   Identify common mainframe vendors (e.g., IBM, Amdahl, Hitachi Data Systems, Digital)

θθθθθ   W.   Demonstrate knowledge of LAN physical media

W.001   Differentiate between baseband and broadband transmission
W.002   Demonstrate knowledge of Manchester encoding
W.003   Identify the criteria used in making cable selection decisions (e.g., physical properties, transmission technologies, transmission span, bandwidth, topology, security, noise immunity, installation considerations, cost)
W.004   Demonstrate knowledge of cable types (e.g., coaxial, twisted-pair, optical fibers)
W.005   Compare/contrast a cable types
W.006   Demonstrate knowledge of types of cable connectors and grounding techniques
W.007   Demonstrate knowledge of typical cable applications
W.008   Demonstrate knowledge of cable standards (e.g., ANSI, EIA/TIA-568, EIA/TIA-569, TWSS, NEC)
W.009   Identify the advantages and disadvantages of LAN cabling systems
W.010   Demonstrate knowledge of LAN system physical layouts
W.011   Demonstrate knowledge of how to conduct cable installation site survey
W.012   Demonstrate knowledge of how to estimate cable and components required based on installation site survey results
W.013   Demonstrate knowledge of checks that need to be made prior to installing cable
W.014   Demonstrate knowledge of the documentation and labeling needed when installing cable
W.015   Demonstrate knowledge of accepted methods for installing cable
W.016   Demonstrate knowledge of typical problems associated with cable installation
W.017   Demonstrate knowledge of cable testing and tolerance levels
W.018   Demonstrate knowledge of possible sources of interference and methods for overcoming each
W.019   Demonstrate knowledge of basic cabling schemes and alternatives

θθθθθ   X.   Demonstrate knowledge of network connectivity basics

X.001   Demonstrate knowledge of the characteristics and functions of point-to-point channels, switched, and meshed network
X.002   Demonstrate knowledge of the characteristics and functions of broadcast channels
X.003   Identify software used to connect networking devices
X.004   Demonstrate knowledge of types of interoperability (e.g., peer-to-peer, peer-to-host)
X.005   Demonstrate knowledge of Internet, Intranet, and Extranet usage and connectivity

θθθθθ   Y.   Demonstrate knowledge of LAN switching

Y.001   Describe the advantages of LAN segmentation.
Y.002   Describe LAN segmentation using bridges.
Y.003   Describe LAN segmentation using routers.
Y.004   Describe LAN segmentation using switches.
Y.005   Name and describe two switching methods.
Y.006   Describe full- and half-duplex Ethernet operation.

Y.007 Describe network congestion problems in Ethernet networks.
Y.008 Describe the benefits of network segmentation with bridges.
Y.009 Describe the benefits of network segmentation with switches.
Y.010 Describe the features and benefits of Fast Ethernet.
Y.011 Describe the guidelines and distance limitations of Fast Ethernet.
Y.012 Distinguish between cut-through and store-and-forward LAN switching.
Y.013 Describe the operation of the Spanning Tree Protocol and its benefits.
Y.014 Describe the benefits of virtual LANs.
Y.015 Define and describe the function of a MAC address.

NETWORK ARCHITECTURES

Aligned with Vermont Standards: 7.17

θθθθθ   Z.   Demonstrate knowledge of the basics of network architecture

Z.001 Demonstrate knowledge of the characteristics and uses of network components (e.g., hub, switches, routers, firewall)
Z.002 Identify LAN transmission methods (e.g., bus, pure ring, star ring topologies)
Z.003 Demonstrate knowledge of broadband and baseband transmission methods and standards
Z.004 Demonstrate knowledge of LAN transmission logic
Z.005 Identify LAN transmission media (e.g., twisted pair, fiber-optic cable, wireless)
Z.006 Demonstrate knowledge of LAN medium-access protocols (e.g., CSMA/CD, token bus, token ring, FDDI)
Z.007 Identify the components of, and relationships within, the OSI 8802 (IEEE 802) protocol suite
Z.008 Demonstrate knowledge of LAN protocol issues with medium-access control and data communications protocol
Z.009 Identify LAN performance factors (signal attenuation, signal propagation delay)
Z.010 Compare/contrast various frame formats for LANs
Z.011 Demonstrate knowledge of frame types (e.g., SNS<802.3, 802.5)
Z.012 Demonstrate a basic knowledge of OSI modelling
Z.013 Differentiate between a physical and logical topology

θθθθθ   AA.   Demonstrate knowledge of network protocols

AA.001 Monitor Novell IPX operation on the router.
AA.002 Describe the two parts of network addressing, then identify the parts in specific protocol address examples.
AA.003 Create the different classes of IP addresses [and subnetting].
AA.004 Configure IP addresses.
AA.005 Verify IP addresses.
AA.006 List the required IPX address and encapsulation type.
AA.007 Enable the Novell IPX protocol and configure interfaces.
AA.008 Identify the functions performed by ICMP.
AA.009 Configure IPX access lists and SAP filters to control basic Novell traffic.

θθθθθ   BB.   Install basic system architectures using current Windows operating system software

BB.001 Configure a client desktop for network communications in Windows
BB.002 Share files between two computers on a network using Windows
BB.003 Design a system to direct cable-connect two computers using Windows
BB.004 Expand PC memory

WIDE-AREA NETWORKS
Aligned with Vermont Standards: 7.17

θθθθθ   CC.   Demonstrate knowledge of basic telecommunications and the interconnection of networks

CC.001 Demonstrate knowledge of WAN technology (e.g., subrate facilities, dataphone, digital service, multiplexers, time division multiplexing, modems, RS-232)
CC.002 Demonstrate knowledge of the different types of WAN connections
CC.003 Demonstrate knowledge of point-to-point (PPP) interconnection
CC.004 Identify basic telecommunications services (e.g., satellite, circuit switching, packet switching, wireless)

CC.005   Differentiate between local exchange carriers (LECs) and interexchange carriers (IXCs or IECs)
CC.006   Define local access and transport areas (LATAs)
CC.007   Identify long-distance carriers and their services
CC.008   Identify packet carriers and their services
CC.009   Identify the role of telecommunications tariffs

θθθθθ   DD.   Demonstrate knowledge of WAN protocols

DD.001   Differentiate between the following WAN services: Frame Relay, ISDN/LAPD, HDLC, & PPP.
DD.002   Recognize key Frame Relay terms and features.
DD.003   List commands to configure Frame Relay LMIs, maps, and subinterfaces.
DD.004   List commands to monitor Frame Relay operation in the router.
DD.005   Identify PPP operations to encapsulate WAN data on routers.
DD.006   State a relevant use and context for ISDN networking.
DD.007   Identify ISDN protocols, function groups, reference points, and channels.
DD.008   Add the RIP routing protocol to your configuration.
DD.009   Add the IGRP routing protocol to your configuration.
DD.010   Explain the services of separate and integrated multiprotocol routing.
DD.011   List problems that each routing type encounters when dealing with topology changes and describe techniques to reduce the number of these problems.
DD.012   Describe the benefits of network segmentation with routers.

NETWORK MANAGEMENT
Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ   EE.   Perform network installation procedures

EE.001   Access needed information using company and manufacturers' references (e.g., procedural manuals, documentation, standards, work flowcharts)
EE.002   Assess user needs to determine which network operating systems to use
EE.003   Set up/configure workstation-network connections
EE.004   Set up/configure network components (e.g., interface cards, printers, and CD-ROM devices)
EE.005   Install modem
EE.006   Install multiplexer
EE.007   Install LAN operating system
EE.008   Configure file server in PC network
EE.009   Construct network cables
EE.010   Test network connectivity using a network analyzer
EE.011   Install cabling
EE.012   Install network

θθθθθ   FF.   Perform network operation procedures

FF.001   Determine the type of wiring needed for the physical connection of the network
FF.002   Connect PCs to form a network
FF.003   Connect PC to mini or mainframe
FF.004   Link mixed vendors (e.g., PC to Mac)
FF.005   Interconnect computers via backbone network
FF.006   Document LAN configuration
FF.007   Identify how the network protocols work together
FF.008   Determine compatibility of various networks
FF.009   Set up/configure TCP/IP services on workstations and network servers
FF.010   Implement print queue in a PC network
FF.011   Program a client-server application
FF.012   Build a synchronous transmission circuit using a modem
FF.013   Perform file-to-file copy in a PC network
FF.014   Install/configure file server in a PC network
FF.015   Operate the system in a multi-user environment

SYSTEM INSTALLATION AND MAINTENANCE
Aligned with Vermont Standards: 1.21, 7.12, 7.17

θθθθθ **GG.** **Perform system maintenance**

GG.001 Demonstrate knowledge of the basic elements of computer maintenance
GG.002 Identify available diagnostic tools used for system maintenance
GG.003 Identify maintenance procedures and processes
GG.004 Identify problems using diagnostic tools
GG.005 Document solutions
GG.006 Tear down a computer
GG.007 Identify (by name) new or replacement computer components needed
GG.008 Install/replace computer components
GG.009 Reassemble a computer
GG.010 Establish a preventive maintenance plan
GG.011 Perform preventive maintenance on computer components
GG.012 Create maintenance plan for regular integrity checks
GG.013 Evaluate maintenance processes
GG.014 Evaluate maintenance outcomes

θθθθθ **HH.** **Perform software upgrades and fixes**

HH.001 Identify principles governing software acquisition and upgrades
HH.002 Analyze operational problems
HH.003 Recommend solutions for operational problems
HH.004 Upgrade software

MANAGEMENT AND SUPERVISION
Aligned with Vermont Standards: : 1.13, 1.14, 1.17, 1.20, 2.2, 2.3, 2.14, 3.3, 3.10, 3.11, 3.12

θθθθθ **II.** **Conduct meetings**

II.001 Plan meeting
II.002 Set agenda
II.003 Schedule meeting
II.004 Reserve meeting room
II.005 Invite appropriate personnel
II.006 Identify need for outside speakers
II.007 Assign someone to take minutes
II.008 Make introductions
II.009 Invite questions, comments, and group participation
II.010 Determine appropriate action, time frame, and person accountable for identified tasks
II.011 Monitor time
II.012 Publish minutes in timely manner

FUNDAMENTALS OF ELECTRONICS TECHNOLOGY
Aligned with Vermont Standards: 7.11, 7.12, 7.17, 7.18, 7.19

θθθθθ **JJ.** **Distinguish between analog and digital phenomena and circuits**

JJ.001 Demonstrate knowledge of the analog and digital measurement techniques for physical parameters (e.g., temperature, time, current, number of items coming down a production line)
JJ.002 Distinguish between an analog and a digital clock
JJ.003 Demonstrate knowledge of the function and operation of the instruments used to measure analog signals
JJ.004 Demonstrate knowledge of the function and operation of the instruments used to measure analog digital signals
JJ.005 Demonstrate knowledge of how an analog signal can be converted to a digital signal
JJ.006 Demonstrate knowledge of how a digital signal can be converted to an analog signal

θθθθθ **KK.** **Demonstrate knowledge of the basic elements of communication interfacing**

KK.001 Demonstrate knowledge of common EIA, IEEE, and ITU-T (formerly CCITT) communication standards (e.g., EIA 232 and 485, IEEE 488) and their applications
KK.002 Demonstrate knowledge of the function and operation of sync devices
KK.003 Demonstrate knowledge of the function and operation of async devices

KK.004 Demonstrate knowledge of types of networks (e.g., token ring, Ethernet)
KK.005 Demonstrate knowledge of networking levels or layers
KK.006 Demonstrate knowledge of protocols
KK.007 Demonstrate knowledge of the function and operation of packet switching
KK.008 Demonstrate knowledge of multi-user systems
KK.009 Demonstrate knowledge of types of network analyzer devices (e.g., breakout box, sniffers)
KK.010 Operate network analyzer devices

θθθθθ LL. Apply troubleshooting and repair techniques to a microcomputer system

LL.001 Demonstrate knowledge of the role of preventive maintenance
LL.002 Differentiate between normal and abnormal operations
LL.003 Demonstrate knowledge of standard troubleshooting procedures
LL.004 Identify available troubleshooting aids and tools
LL.005 Demonstrate knowledge of safety rules for troubleshooting and repair
LL.006 Demonstrate knowledge of the techniques for identifying thermal failures
LL.007 Identify logical actions to take for a specific troubleshooting situation
LL.008 Secure needed information using diagnostic software
LL.009 Secure needed information using manufacturer's manuals, schematics, and troubleshooting charts
LL.010 Interpret prints
LL.011 Isolate faults to systems boards
LL.012 Isolate faults to memory circuits
LL.013 Isolate faults to data storage devices
LL.014 Isolate faults in power supplies
LL.015 Troubleshoot I/O ports
LL.016 Isolate faults in I/O interface circuitry
LL.017 Repair faults
LL.018 Maintain troubleshooting and repair records

TELECOMMUNICATIONS
Aligned with Vermont Standards: 7.11, 7.12, 7.17, 7.18, 7.19

θθθθθ MM. Demonstrate knowledge of transmission line applications

MM.001 Define power conversion
MM.002 Demonstrate knowledge of the principles and operation of two-wire and four-wire transmission lines
MM.003 Demonstrate knowledge of the principles and operation of coaxial cable
MM.004 Demonstrate knowledge of the principles and operation of a microwave guide and wireless
MM.005 Demonstrate knowledge of the principles and operation of fiber optics, analog, and digital circuits

θθθθθ NN. Demonstrate proficiency in working with data communications

NN.001 Demonstrate knowledge of the principles and operation of data communications, signaling systems, codes, formats, and protocols
NN.002 Demonstrate knowledge of the principles and operation of parallel and serial ports
NN.003 Demonstrate knowledge of the principles and operation of synchronous and asynchronous signals
NN.004 Demonstrate knowledge of the principles and operation of data modems
NN.005 Operate data modems
NN.006 Demonstrate knowledge of the principles and operation of fax machines
NN.007 Demonstrate knowledge of the principles and operation of various types of networks (e.g., Ethernet, token ring)
NN.008 Operate various types of networks
NN.009 Employ accepted techniques for cable termination (e.g., UTP, COAX, FIBER)

MultiMedia Design Concentration
CIP: 11.0801

<table>
<tr><td colspan="5" align="center">Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:</td></tr>
<tr><td align="center">0
No Exposure</td><td align="center">1
Introduced</td><td align="center">2
Practiced</td><td align="center">3
Entry-level</td><td align="center">4
Competency</td></tr>
</table>

DIGITAL MEDIA DESIGN
Aligned with Vermont Standards: 1.21, 2.4, 2.10, 2.14, 7.17

0 1 2 3 4

θθθθθ   L.   Demonstrate knowledge of design principles

θθθθθ   M.   Demonstrate design skills

COMPUTER GRAPHICS
Aligned with Vermont Standards: 1.21, 2.4, 2.10, 7.17

θθθθθ   N.   Import graphics from peripheral devices

θθθθθ   O.   Create computer graphics using graphics software programs

θθθθθ   P.   Manipulate images

3-D MODELING
Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθθ   Q.   Demonstrate knowledge of the basic principles of 3-D modeling

θθθθθ   R.   Create and modify 3-D models

θθθθθ   S.   Map Materials and Environmental Effects

θθθθθ   T.   Apply animation techniques

2 – D COMPUTER ANIMATION
Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθθ   U.   Demonstrate knowledge of the basic principles of animation

θθθθθ   V.   Animate characters

3 – D COMPUTER ANIMATION
Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθθ   W.   Demonstrate knowledge of the basic principles of animation

θθθθθ   X.   Animate characters

INTERACTIVE MULTIMEDIA
Aligned with Vermont Standards: 1.21, 7.17, 7.18, 7.19

θθθθθ   Y.   Demonstrate knowledge of interactive media

θθθθθ   Z.   Combine media elements to produce interactive multimedia

INTERNET BASICS
Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ   AA.   Describe the physical and organizational structure of the Internet

θθθθθ   BB.   Use internet services and applications

STATIC WEB PAGE DESIGN
Aligned with Vermont Standards: 1.8, 1.10, 1.18, 1.19, 1.21, 2.2, 2.12, 2.13, 2.14, 7.17, 7.18

θθθθθ   CC.   Create static web pages

θθθθθ   DD.   Static web page with advanced elements

DYNAMIC WEB PAGE DESIGN
Aligned with Vermont Standards: 1.8, 1.10, 1.18, 1.19, 1.21, 2.2, 2.12, 2.13, 2.14, 7.17, 7.18

θθθθθ   EE.   Understand components of dynamic web page design

INTERNET SCRIPTING AND PROGRAMMING
Aligned with Vermont Standards: 1.21, 2.2, 2.4, 2.13, 2.14, 7.17, 7.19

θθθθθ   FF.   Integrate Scripts in Web Site Development

θθθθθ   GG.   Internet Programming Concepts

DATABASE DESIGN AND INTERACTION
Aligned with Vermont Standards: 1.21, 7.17

θθθθθ   HH.   Demonstrate knowledge of database design

θθθθθ   II.   Use databases in a web environment

θθθθθ   JJ.   Use Structured Query Language

ADVANCED DATA COMMUNICATIONS
Aligned with Vermont Standards: 1.21, 7.17

θθθθθ   KK.   Understand components of advanced communications

SERVER DEVELOPMENT AND MAINTENANCE
Aligned with Vermont Standards: 2.2, 2.4, 2.12

θθθθθ   LL.   Understand components of server development and maintenance

INTERACTIVE MEDIA PRODUCTION PROCESS
Aligned with Vermont Standards: 1.21, 2.4, 2.10, 2.13, 2.14, 7.17, 7.19

θθθθθ   MM.   Understand components of interactive media production process

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Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

DIGITAL MEDIA DESIGN
Aligned with Vermont Standards: 1.21, 2.4, 2.10, 2.14, 7.17

0 1 2 3 4

θθθθθ   **L.**   **Demonstrate knowledge of design principles**

L.001   Demonstrate knowledge of the principles and elements of design and their relationship to each other
L.002   Demonstrate knowledge of the web safe color
L.003   Demonstrate knowledge of picas, points, and their conversion to inches
L.004   Integrate human factors and user interface in visual design
L.005   Evaluate visual appeal of design

θθθθθ   **M.**   **Demonstrate design skills**

M.001   Apply elements of design (e.g., line, shape, color)
M.002   Develop rough and comprehensive layouts
M.003   Create various mock-ups and dummies
M.004   Select appropriate style for desired impact
M.005   Design computer model objects for function
M.006   Select appropriate media types
M.007   Design user interface
M.008   Design navigation schema
M.009   Create/refine design concepts

COMPUTER GRAPHICS
Aligned with Vermont Standards: 1.21, 2.4, 2.10, 7.17

θθθθθ   **N.**   **Import graphics from peripheral devices**

N.001   Identify types of digital imaging software
N.002   Demonstrate knowledge of the characteristics and operation of digital imaging equipment (e.g., scanner, digital camera, video input devices, printer, and output devices)
N.003   Compare performance of different types of image acquisition hardware

θθθθθ   **O.**   **Create computer graphics using graphics software programs**

O.001   Compare/contrast different types of graphics software
O.002   Demonstrate knowledge of graphic tools, menus, and functions, such as grouping, transformations and blending
O.003   Demonstrate knowledge of simple and advanced development tools, styles, templates, and wizards
O.004   Select the most effective graphics software for the intended uses
O.005   Identify types of graphics
O.006   Define audience and purpose of graphics
O.007   Select the appropriate style of graphics based on the intended purpose
O.008   Create graphics that integrate principles of communication and elements of visual design
O.009   Manipulate color, shape, size, and textures of graphics
O.010   Import objects from other applications
O.011   Export objects to other applications
O.012   Rotate graphics
O.013   Rotate text
O.014   Paint/touch up images
O.015   Store images in appropriate formats and resolutions for specific applications
O.016   Save/retrieve graphics
O.017   Print graphics to various output devices

θθθθ P. Manipulate images

P.001   Identify image file formats
P.002   Manipulate levels
P.003   Convert file formats
P.004   Manipulate contrast
P.005   Crop images
P.006   Scale images
P.007   Adjust images using various filtration methods
P.008   Adjust images using selection tools
P.009   Adjust images using painting and editing tools
P.010   Optimize images for specific uses

3-D MODELING
Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθ Q. Demonstrate knowledge of the basic principles of 3-D modeling

Q.001   Demonstrate knowledge of how to convert objects from two-dimensional to three-dimensional
Q.002   Demonstrate knowledge of how a computer deals with geometry
Q.003   Identify the software available for 3-D modeling
Q.004   Demonstrate knowledge of the steps for building a 3-D model
Q.005   Demonstrate knowledge of the components of a wireframe model

θθθθ R. Create 3-D models

R.001   Create a model using 3-D modeling software
R.002   Determine desired camera angle
R.003   Adjust lighting angle, focus, and color to achieve desired effect
R.004   Adjust surface color, texture, transparency, and reflectivity to achieve desired effect
R.005   Compare/contrast flat shading, curved shading, and ray tracing
R.006   Render the object using flat shading
R.007   Render the object using curved shading
R.008   Render the object using ray tracing
R.009   Combine models to create a scene
R.010   Render the completed scene

θθθθ S. Map Materials and Environmental Effects

S.001   Create buildings and rooms
S.002   Import buildings and rooms
S.003   Create land forms
S.004   Import land forms
S.005   Create bodies of water (e.g., lakes, rivers, oceans, waterfalls)
S.006   Create basic water textures, reflections, refractions, and splashing
S.007   Incorporate fog and background images
S.008   Manipulate particle systems such as rain and snow
S.009   Apply lighting effects
S.010   Add special effects

θθθθ T. Apply Animation Techniques

T.001   Follow basic animation principles
T.002   Perform basic texture-mapping algorithms
T.003   Perform basic antialiasing
T.004   Apply ray tracing and radiosity methods
T.005   Perform basic volume-rendering algorithms
T.006   Perform surface detail modeling
T.007   Develop basic curves and surfaces

2-D COMPUTER ANIMATION
Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθ   U.   Demonstrate knowledge of the basic principles of animation

U.001   Demonstrate knowledge of the principles of continuity, key frames, motion paths, and motion
U.002   Demonstrate knowledge of the uses of special effects and virtual navigation
U.003   Identify available animation software programs/tools
U.004   Demonstrate knowledge of 2-D sprite animation
U.005   Demonstrate knowledge of the principles of cell animation

θθθθ   V.   Animate characters

V.001   Demonstrate knowledge of how to design a character based on a narrative context
V.002   Demonstrate knowledge of how to animate a character so as to express its nature
V.003   Demonstrate knowledge of how to capture motion
V.004   Design 2-D characters
V.005   Develop characters in accordance with designs

3-D COMPUTER ANIMATION
Aligned with Vermont Standards: 1.17, 1.21, 7.17

θθθθ   W.   Demonstrate knowledge of the basic principles of animation

W.001   Demonstrate knowledge of the principles of continuity, key frames, motion paths, and motion
W.002   Demonstrate knowledge of the uses of special effects and virtual navigation
W.003   Identify available animation software programs/tools
W.004   Demonstrate knowledge of the principles of cell animation
W.005   Demonstrate knowledge of pre-rendered 3-D animation
W.006   Demonstrate knowledge of real-time 3-D animation

θθθθ   X.   Animate characters

X.001   Demonstrate knowledge of how to design a character based on a narrative context
X.002   Demonstrate knowledge of how to animate a character so as to express its nature
X.003   Demonstrate knowledge of how to capture motion
X.004   Design 3-D models of characters
X.005   Develop characters in accordance with designs

INTERACTIVE MULTIMEDIA
Aligned with Vermont Standards: 1.21, 7.17, 7.18, 7.19

θθθθ   Y.   Demonstrate knowledge of interactive media

Y.001   Perform critical review of various interactive media end products
Y.002   Identify rights, responsibilities, and controls related to various interactive media
Y.003   Interpret intellectual property laws relative to interactive media
Y.004   Analyze the social and cultural implications of interactive media
Y.005   Identify key criticisms of interactive media
Y.006   Identify possible markets for interactive media (e.g., sales and marketing, interactive advertising, K-12 education, corporate training, corporate communications, distance learning, news, entertainment)
Y.007   Identify specific uses of interactive media in each potential market
Y.008   Identify future trends in interactive media

θθθθθ **Z. Combine media elements to produce interactive multimedia**

Z.001 Apply visual design skills
Z.002 Generate text for multi-image presentations (e.g., title slides, charts, graphs)
Z.003 Record sound track, including narration, voice-overs, sound effects, and music
Z.004 Integrate sound with visuals
Z.005 Build in hotspots and interactive links
Z.006 Synthesize available interactive media technologies into a unified presentation using appropriate authoring software
Z.007 Select appropriate hardware tools for media creations
Z.008 Select appropriate software tools for media creations
Z.009 Select the media elements (e.g., sound, video, graphics, text, animation) to be used

INTERNET BASICS
Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ **AA. Describe the concepts and physical and organizational structure of the Internet**

AA.001 Define Internet Related Terminology
AA.002 Draw conceptual model of the Internet and World Wide Web
AA.003 Identify function of Internet Organizations.
AA.004 Identify characteristics of Internet Protocols
AA.005 Compare Internet connection services
AA.006 Demonstrate method for determining Internet identity of a business (hosting domain, subleasing domain, virtual domain hosting)

θθθθθ **BB. Use Internet Services and Applications.**

BB.001 Demonstrate functions and features of Internet browsers.
BB.002 Demonstrate ethics and safety on the Internet
BB.003 Demonstrate an understanding of legal issues relating to the Internet
BB.004 Use Internet Services and Applications
BB.005 Download, install and use browser, applications, and plug-ins.
BB.006 Contrast using Internet applications vs plugs-ins
BB.007 Demonstrate proper use of E-mail
BB.008 Demonstrate effective use of search engines
BB.009 Demonstrate skills in accessing and using newsgroups
BB.010 Demonstrate competency in using online resources
BB.011 Demonstrate ability to conduct business on the Internet (order processing, etc.)
BB.012 Demonstrate skills in participating in online community
BB.013 Demonstrate ability to participate in online learning module
BB.014 Install and use FTP program

STATIC WEB PAGE DESIGN
Aligned with Vermont Standards: 1.8, 1.10, 1.18, 1.19, 1.21, 2.2, 2.12, 2.13, 2.14, 7.17, 7.18

θθθθθ **CC. Create static web**

CC.001 Demonstrate knowledge of the structure of markup languages used in Web Page Design.
CC.002 Create Headers, Paragraphs, and List.
CC.003 Add Character Formatting to a Web Page.
CC.004 Insert and format images tags and attributes.
CC.005 Create and use hyperlinks and anchor tags.
CC.006 Create websites using a variety of web page structures.
CC.007 Create Styles Sheets and CSS properties in Web Page Design
CC.008 Use Font and Body tag attributes to produce color schemes in a Web Page.
CC.009 Demonstrate appropriate use of different Image types in a Web Page.
CC.010 Insert images and control image placement and size.
CC.011 Demonstrate understanding of image maps.
CC.012 Create and format tables.
CC.013 Control web page layout by controlling table appearance, alignment, and placement.
CC.014 Create a Frame Layout Web Page Design.

CC.015   Control the appearance of Frame elements.
CC.016   Control the actions of Hyperlink text within a Frame Layout.

θθθθθ   **DD.   Static Web Page with Advanced Elements**

DD.001   Demonstrate understanding of online form actions and methods.
DD.002   Create form elements.
DD.003   Work with form element properties.
DD.004   Identify security issues relating to use of forms.
DD.005   Create External CSS Stylesheet
DD.006   Create and apply styles to a web page.
DD.007   Apply ID, Classes, DIV and SPAN tags.
DD.008   Demonstrate effective use of CSS attributes within web page development model.

DYNAMIC WEB PAGE DESIGN
Aligned with Vermont Standards: 1.8, 1.10, 1.18, 1.19, 1.21, 2.2, 2.12, 2.13, 2.14, 7.17, 7.18

θθθθθ   **EE.   Understand components of dynamic web page design.**

EE.001   Create dynamic web pages that interact with the user (using DHTML)
EE.002   Use modern techniques to separate content from format (XML and XSLT)

INTERNET SCRIPTING AND PROGRAMMING
Aligned with Vermont Standards: 1.21, 2.2, 2.4, 2.13, 2.14, 7.17, 7.19

θθθθθ   **FF.   Integrate Scripts in Web Site Development**

FF.001   Identify the characteristics of Client Side Scripting
FF.002   Insert a client side script into a Web Page
FF.003   Modify parameters of client side script
FF.004   Identify the characteristics of Server Side Scripting
FF.005   Insert a Service-side Script into a Web Page
FF.006   Modify parameters of a Server Side Script
FF.007   Locate host service providers for various type of scripting options.
FF.008   Identify characteristics of various types of scripting languages.

θθθθθ   **GG.   Internet Programming Concepts**

GG.001   Use variables for data storage and calculations
GG.002   Use correct data types and naming conventions
GG.003   Calculate values
GG.004   Declare, populate, and use arrays
GG.005   Use arithmetic operators
GG.006   Implement control structure
GG.007   Use built in functions and methods
GG.008   Use event procedures
GG.009   Use built in objects of a programming language
GG.010   Create and use custom objects

DATABASE DESIGN AND INTERACTION
Aligned with Vermont Standards: 1.21, 7.17

θθθθθ   **HH.   Demonstrate knowledge of database design**

HH.001   Create an Entity Relationship Diagram to model a business needs and functions
HH.002   Create and populate database table
HH.003   Create relationship in a database
HH.004   Create queries from multiple tables
HH.005   Create reports from database

θθθθ   II.   **Use databases in a web environment**

II.001   Use and ODBC connection
II.002   Demonstrate understanding of URL parameters
II.003   Retrieve data from a database into a Web Page
II.004   Insert data into a database from a Web Page Form
II.005   Maintain data in a database from a Web Environment

θθθθ   JJ.   **Use Structured Query Language**

JJ.001   Retrieve data
JJ.002   Insert data
JJ.003   Update data
JJ.004   Delete data
JJ.005   Create and maintain database objects
JJ.006   Control transactions
JJ.007   Control data/user access
JJ.008   Retrieve data using additional advanced techniques.

ADVANCED DATA COMMUNICATIONS
Aligned with Vermont Standards: 1.21, 7.17

θθθθ   KK.   **Understand components of advanced data communications.**

KK.001   Demonstrate knowledge of networking basics
KK.002   Demonstrate knowledge of networking security

SERVER DEVELOPMENT AND MAINTENANCE
Aligned with Vermont Standards: 2.2, 2.4, 2.12

θθθθ   LL.   **Understand components of server development and maintenance.**

LL.001   Install an operating system to create a server
LL.002   Configure a computer to act as a Web and FTP server
LL.003   Maintain a server

INTERACTIVE MEDIA PRODUCTION PROCESS
Aligned with Vermont Standards: 1.21, 2.4, 2.10, 2.13, 2.14, 7.17, 7.19

θθθθ   MM.   **Understand components of interactive media production process.**

MM.001 Identify and participate in steps of the pre-production process (i.e. planning, working with audience, etc)
MM.002 Select layout and design that best meet project goals
MM.003 Test usability of navigation and interface design
MM.004 Demonstrate understanding of accessibility and internationalization implications on project
MM.005 Participate in various phases and roles of the media creation process
MM.006 Participate in phases of project assembly, testing and optimization
MM.007 Participate in stages of production, implementation, hosting, dissemination

COMPUTER INSTALLATION & REPAIR CONCENTRATION
CIP: 47.0104

Occupational Skills
The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

HARDWARE SERVICE TECHNICIAN

Aligned with Vermont Standards: 1.14, 1.18, 1.19, 1.21, 7.11, 7.12, 7.17

0 1 2 3 4

⊖⊖⊖⊖⊖　　L.　　Installation, Configuration, and Upgrading

⊖⊖⊖⊖⊖　　M.　　Diagnose and Troubleshoot

⊖⊖⊖⊖⊖　　N.　　Preventive Maintenance, Safety, and Environmental Issues

⊖⊖⊖⊖⊖　　O.　　Motherboards, Processors, and Memory

⊖⊖⊖⊖⊖　　P.　　Printers

⊖⊖⊖⊖⊖　　Q.　　Basic Networking

OPERATING SYSTEM TECHNOLOGIES

Aligned with Vermont Standards: 2.13, 7.3aaa, 7.17

⊖⊖⊖⊖⊖　　R.　　Operating System Fundamentals

⊖⊖⊖⊖⊖　　S.　　Installation, Configuration, and Upgrade

⊖⊖⊖⊖⊖　　T.　　Diagnose and Troubleshoot

⊖⊖⊖⊖⊖　　U.　　Networks

NETWORKING

ALIGNED WITH VERMONT STANDARDS: 1.21, 2.10, 2.14, 7.17

⊖⊖⊖⊖⊖　　V.　　Media and Topologies

⊖⊖⊖⊖⊖　　W.　　Protocols and Standards

⊖⊖⊖⊖⊖　　X.　　Network Implementation

θθθθθ   Y.   Network Support

WEB PAGE DESIGN AND IMPLEMENTATION
Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ   Z.   Create Static Web Pages

θθθθθ   AA.   Create Static Web Pages with Advanced Elements

θθθθθ   BB.   Internet Programming Concepts

DATABASE DESIGN AND IMPLEMENTATION
Aligned with Vermont Standards: 1.21, 1.22

θθθθθ   CC.   Demonstrate Knowledge of Database Design

θθθθθ   DD.   Use Structured Query Language

θθθθθ   EE.   Use Databases in a Web Environment

COMPUTER PROGRAMMING
Aligned with Vermont Standards: 1.21, 1.22, 2.10, 2.11, 2.12, 2.13, 2.14, 7.17

θθθθθ   FF.   Program Design

θθθθθ   GG.   Documentation

θθθθθ   HH.   Develop Computer Programs in Accordance with Programming Theory

θθθθθ   II.   Incorporate Testing in Programs

Occupational Skills

The Student demonstrates the specified level of competency in occupational skills:

0	1	2	3	4
No Exposure	Introduced	Practiced	Entry-level	Competency

HARDWARE SERVICE TECHNOLOGY
Aligned with Vermont Standards: 1.14, 1.18, 1.19, 1.21, 7.11, 7.12, 7.17

0 1 2 3 4

θθθθθ　　　L.　　　Installation, Configuration, and Upgrading

L.001　Identify the names, purpose, and characteristics of internal system components, case and ports recognizing by sight or definition

L.002　Identify basic procedures (and appropriate sequence) for adding and removing field-replaceable components for desktop systems

L.003　Identify basic procedures (and appropriate sequence) for adding and removing field-replaceable components for portable systems

L.004　Identify typical IRQs, DMAs, and I/O addresses, and procedures (steps) for altering these setting when installing and configuring devices.

L.005　Identify the names, purposes, and performance characteristics of common peripheral ports recognizing ports, cabling, and connectors by sight or definition

L.006　Identify proper procedures and sequence for installing and configuring common IDE devices and recognize associated cables

L.007　Identify proper procedures and sequence for installing and configuring common SCSI devices and recognize the associated cables

L.008　Identify proper procedures for installing and configuring common peripheral devices

L.009　Identify procedures to optimize PC operations in specific situations. Predict the effects of specific procedures under given scenarios (Cooling systems, Disk subsystem enhancements, NICs, Specialized video cards, Memory, Additional processors)

L.010　Determine the issues that must be considered when upgrading a PC including when and how to upgrade system components

θθθθθ　　　M.　　　Diagnose and Troubleshoot

M.001　Recognize common problems associated with each component and their symptoms, identifying steps to isolate and troubleshoot the problems and finding the most likely cause (Ports and cables, Motherboards, Peripherals, Computer case, Storage devices and cables, Cooling systems, Processor, Memory, Display device, Input devices, Adapters, Portable systems)

M.002　Identify basic troubleshooting procedures and tools, and how to elicit problem symptoms from the customer (Gather information, Determine whether the problem is a hardware or software problem, Troubleshoot to isolate the problem)

θθθθθ　　　N.　　　Preventive Maintenance, Safety, and Environmental Issues

N.001　Identify the various types of preventive maintenance measures, products and procedures and when and how to use them (Cleaning compounds, Non-static vacuums, Cleaning monitors and removable media devices, Ventilation, dust and moisture control inside the PC, Hard disk maintenance, Verifying integrity of UPS and suppressors)

N.002　Identify various safety measures and procedures, and when/how to use them (ESD: What it is and how to protect from it, Potential hazards and proper safety procedures: High-voltage equipment, Power supplies, CRTs)

N.003　Identify environmental protection measures and procedures, and when/how to use them (Disposal guidelines: batteries, CRTs, chemical solvents and cans, MSDS (Material Safety Data Sheet))

θθθθθ   **O.**   **Motherboards, Processors, and Memory**

O.001   Distinguish between the popular CPU chips in terms of their basic characteristics (Pentium class compatible, voltage, speeds, cache, sockets/slots, VRMs)

O.002   Identify the types of RAM, form factors, and operational characteristics and determine banking and speed requirements under different scenarios (RAM: EDO RAM, DRAM…, Form factors: SIMM, DIMM…, Operational characteristics: 8, 16, 32-bit, parity vs non-parity, ECC vs. non-ECC, single-sided vs. double-sided),

O.003   Identify the most popular types of motherboards, their components, and their architecture (bus structure) (AT/ATX, chipsets, ports, memory, processor socket, external cache, bus architecture, expansion slots, IDE (ATA, ATAPI, ULTRA-DMA, EIDE), SCSI)

O.004   Identify the purpose of CMOS memory, what it contains, and how and when to change its parameters. Given a scenario involving CMOS, choose the appropriate course of action.

θθθθθ   **P.**   **Printers**

P.001   Identify printer technologies, interfaces, and options/upgrades (Technologies: Laser, ink dispersion, dot matrix, solid ink, thermal, dye sublimation, Interfaces: Parallel, network, SCSI, USB, infrared, serial, IEEE1394/Firewire, wireless, options/upgrades: memory, hard drives, NICs, trays and feeders, finishers (stapling, etc.), Scanner/Fax/copier)

P.002   Recognize common printer problems and techniques used to resolve them

θθθθθ   **Q.**   **Basic Networking**

Q.001   Identify the common types of network cables, their characteristics and connectors (Cable types: coaxial, plenum/PVC, UTP, STP, Fiber, Connector types: BNC, RJ-45, AUI, ST/SC, IDC/UDC)

Q.002   Identify basic networking concepts including how a network works (Install and configure NICs, addressing, bandwidth, status indicators, protocols, full-duplex, half-duplex, cabling, networking models (peer-to-peer, client/server), infrared, wireless)

Q.003   Identify common technologies available for establishing Internet connectivity (LAN, DSL, cable, ISDN, dial-up, satellite, wireless) and their characteristics (definition, speed, connections)

OPERATING SYSTEM TECHNOLOGIES
Aligned with Vermont Standards: 2.13, 7.3aaa, 7.17

θθθθθ   **R.**   **Operating System Fundamentals**

R.001   Identify the major desktop components and interfaces, and their functions differentiating the characteristics of current versions of Microsoft Windows (Windows 9x/Me, NT4.0 Workstation, 2000 Professional, and XP)

R.002   Identify the names, locations, purposes, and contents of major file systems (Windows 9x and NT-based systems)

R.003   Demonstrate the ability to use command-line functions and utilities to manage the operating system, including the proper syntax and switches (DOS commands)

R.004   Identify basic concepts and procedures for creating, viewing, and managing disks, directories and files including procedures for changing file attributes and the ramifications of those changes (Disk partitions, file systems, directory structures, files)

R.005   Identify the major operating system utilities, their purposes, location, and available switches (Disk management tools, System management tools, File management tools)

θθθθθ   **S.**   **Installation, Configuration, and Upgrade**

S.001   Identify the procedures for installing current Microsoft operating systems and bringing the operating systems to a basic operational level (Windows 9x/Me, NT4.0 Workstation, 2000 Professional, and XP) (Verify hardware compatibility and minimum requirements, Determine OS installation options, Disk preparation order, Run appropriate setup utility (Setup, Winnt), Installation methods, Device driver configuration, Restore user data files, Identify common symptoms and problems)

S.002   Identify steps to perform an operating system upgrade using combinations of current Microsoft Windows operating systems. Given an upgrade scenario, choose the appropriate next step. (Upgrade paths available, Verify hardware compatibility and minimum requirements, Verify application compatibility, Determine correct upgrade startup utility, Apply OS service packs, patches and updates, Install additional Windows components)

S.003   Identify the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed for each current Windows operating system version (Boot sequence, Alternative boot methods, Creating emergency disks with DOS utilities, Creating ERD with Windows)

S.004   Identify procedures for installing/adding a device including loading, adding, and configuring device drivers and required software (Determine if permissions are adequate for performing the task, Device driver installation, Install additional Windows components)

S.005   Identify procedures necessary to optimize the operating system and major operating system subsystems (Virtual memory management, disk defragmentation, files and buffers, caches, temporary file management)

θθθθ   T.   Diagnose and Troubleshoot

T.001   Recognize and interpret the meaning of common error codes and startup messages from the boot sequence, and identify steps to correct the problems (Boot failure and errors, Startup messages, A device referenced in SYSTEM.INI, WIN.INI, Registry is not found, Event log is full, Failure to start GUI, Windows protection error, Registry corrupt, Use the correct utilities (Dr. Watson, Boot Disk, Event Viewer))

T.002   Recognize when to use common diagnostic utilities and tools. Given a diagnostic scenario involving one of these utilities or tools, select the appropriate steps needed to resolve the problem (Startup disks, Startup modes, Diagnostic tools, utilities, and resources, Elicit symptoms from the customer, Have customer reproduce error, Identify recent changes to the system)

T.003   Recognize common operational and usability problems and determine how to resolve them (Troubleshooting Windows-specific printing problems, Other common problems, Viruses and virus types)

θθθθ   U.   Networks

U.001   Identify the networking capabilities of Windows. Given configuration parameters, configure the operating system to connect to a network (Configure protocols, Configure client options, Verify the configuration, Understand the use of network troubleshooting commands, Share resources, Set permissions to shared resources, Network type and card)

U.002   Identify the basic Internet protocols and terminologies. Identify procedures for establishing Internet connectivity. In a given scenario, configure the operating system to connect to and use Internet resources (Protocols and terminologies: ISP, TCP/IP, etc.), Connectivity technologies (Dial-up, DSL, etc.), Installing and configuring browsers, Firewall protection under Windows XP)

NETWORKING

Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθ   V.   Media and Topologies

V.001   Describe or identify network topologies (e.g., star, bus, mesh, ring, wireless)

V.002   Specify the main features of current popular 802 standard networking technologies (LLC, Ethernet, token ring, wireless and FDDI) include speed, access, method, topology, and media

V.003   Specify the characteristics of 10BASE2, 10BASE5, 10BASET…Gigabit Ethernet (speed, access, method, topology, and media)

V.004   Recognize media connectors and describe their uses (RJ-11, RJ-45, AUI, BNC, ST/SC)

V.005   Choose the appropriate media type and connectors to add a client to an existing network

V.006   Identify the purpose, features, and functions of the following network components: hubs, switches, bridges, routers, gateways, CSU/DSU, NICs/ISDN adapters, wireless access points, modems

θθθθ   W.   Protocols and Standards

W.001   Identify and explain a MAC address

W.002   Identify the seven layers of the OSI model and their functions

W.003   Differentiate between the following network protocols in terms of routing, addressing schemes, interoperability, and naming conventions: TCP/IP, IPX/SPX, NetBEUI, AppleTalk

W.004   Identify the OSI layers at which the following network components operate: hubs, switches, bridges, routers, network interface cards

W.005   Define the purpose, function and/or use of the following protocols within TCP/IP: IP, TCP, UDP, FTP,TFTP, SMTP, HTTP, HTTPS, POP3/MAP4, TELNET, ICMP, ARP, NTP

W.006   Define the function of TCP/UDP ports and identify well known ports

W.007   Identify the purpose of the following network services: DHCP/bootp, DNS, NAT/ICS, WINS, and SNMP

W.008   Identify IP address and their default subnet masks (Ipv4, Ipv6)

W.009   Identify the purpose of subnetting and default gateways

W.010   Identify the differences between public vs. private networks

W.011 Identify the basic characteristics (speed, capacity, media) of the following WAN technologies: Packet switching vs. circuit switching, ISDN, FDDI, ATM, Frame Relay, Sonet/SDH, T1/E1, T3/E3, OCx
W.012 Define the function of these remote access protocols and services: RAS, PPP, PPTP, ICA
W.013 Identify security protocols and describe their purpose and function: IPsec, L2TP, SSL, Kerberos

θθθθθ X. Network Implementation

X.001 Identify the basic capabilities of these server operating systems: UNIX/ Linux, Netware, Windows, Macintosh (i.e. client support, interoperability, authentication, file and print services, application support, and security)
X.002 Identify the basic capabilities of client workstations (i.e., client connectivity, local security mechanisms, and authentication)
X.003 Identify the main characteristics of VLANs
X.004 Identify the main characteristics of network attached storage
X.005 Identify the purpose and characteristics of fault tolerance
X.006 Identify the purpose and characteristics of disaster recovery
X.007 Given a remote connectivity scenario configure the connection (e.g., IP, IPX, dial-up, PPPoE, authentication, physical connectivity etc.)
X.008 Identify the purpose, benefits and characteristics of using a firewall
X.009 Identify the purpose, benefits and characteristics of using a proxy
X.010 Given a scenario, predict the impact of a particular security implementation on network functionality (e.g., blocking port numbers, encryption, etc.)
X.011 Given a network configuration, select the appropriate NIC and network configuration settings (DHCP, DNS, WINS, protocols, NETBIOS/host name, etc.)

θθθθθ Y. Network Support

Y.001 Given a troubleshooting scenario, select the appropriate TCP/IP utility: Tracert, Ping, Arp, Netstat, Nbstat, Ipconfig/Ifconfig, Winipcfg, Nslookup
Y.002 Given a troubleshooting scenario involving a small office/home office network failure identify the cause of the failure (e.g., xDSLI, cable, home satellite, wireless, POTS)
Y.003 Given a troubleshooting scenario involving a remote connectivity problem identify the cause of the problem (e.g., authentication failure, protocol configuration, physical connectivity)
Y.004 Given specific parameters, configure a client to connect to the following servers: UNIX/Linux, Netware, Windows, Macintosh
Y.005 Given a wiring task, select the appropriate tool: Wire crimper, media tester/certifier, punch down tool, tone generator optical tester, etc.
Y.006 Given a network scenario interpret visual indicators to determine the nature of the problem (e.g., link lights, collision lights, etc.)
Y.007 Given output from a diagnostic utility, identify the utility and interpret the output (e.g., tracert, ping, etc.)
Y.008 Given a network problem scenario, predict the impact of modifying, adding, or removing network services on network resources and users (e.g., DHCP, DNS, WINS, etc.)
Y.009 Given a network problem scenario, select an appropriate course of action based on a general troubleshooting strategy. (*See Network+ Exam Objective 4.9 for steps)
Y.010 Given a troubleshooting scenario involving a network with a particular physical topology (i.e., bus, star, mesh, ring, and wireless) and including a network diagram, identify the network area affected and the cause of the problem
Y.011 Given a network troubleshooting scenario involving a client connectivity problem (e.g., incorrect protocol/client software/authentication configuration, or insufficient rights/permission), identify the cause of the problem
Y.012 Given a network troubleshooting scenario involving a wiring/infrastructure problem, identify the cause of the problem (e.g., bad media, interference, network hardware)

WEB PAGE DESIGN AND IMPLEMENTATION
Aligned with Vermont Standards: 1.21, 2.10, 2.14, 7.17

θθθθθ Z. Create Static Web Pages

Z.001 Demonstrate knowledge of the structure of markup languages used in Web Page Design
Z.002 Create headers, paragraphs, and lists
Z.003 Add character formatting to a Web Page
Z.004 Insert and format image, tags and attributes
Z.005 Create and use Hyperlinks and Anchor tags

Z.006   Create Web sites using a variety of Web page structures
Z.007   Create style sheets in Web Page design
Z.008   Use font and body tag attributes to produce color schemes in a Web Page
Z.009   Demonstrate appropriate use of different image types in a Web Page
Z.010   Insert images and control image placement and size
Z.011   Demonstrate understanding of image maps
Z.012   Create and format tables
Z.013   Control Web page layout by controlling table appearance, alignment, and placement
Z.014   Create a frame layout Web Page design
Z.015   Control the appearance of frame elements
Z.016   Control the actions of Hyperlink text within a frame layout

θθθθθ   AA.   Create Static Web Pages with Advanced Elements

AA.001   Demonstrate understanding of online form actions and methods
AA.002   Create form elements
AA.003   Work with form element properties
AA.004   Identify security issues related to the use of forms
AA.005   Create and apply styles to a Web page

θθθθθ   BB.   Internet Programming Concepts

BB.001   Use variables for data storage and calculations
BB.002   Use correct data types and naming conventions
BB.003   Calculate values
BB.004   Declare, populate, and use arrays
BB.005   Use arithmetic operations
BB.006   Implement control structures
BB.007   Use built-in functions and methods
BB.008   Use event procedures
BB.009   Use built-in objects of a programming language
BB.010   Create and use custom objects

DATABASE DESIGN AND IMPLEMENTATION
Aligned with Vermont Standards: 1.21, 1.22

qqqqq   CC.   Demonstrate Knowledge of Database Design

CC.001   Create an entity relationship diagram to model the needs and functions of a business
CC.002   Create and populate database tables
CC.003   Create relationships in databases
CC.004   Create calculated fields
CC.005   Create queries from multiple tables
CC.006   Create forms from one or more tables
CC.007   Create simple and complex reports from one or more tables (detail, summary, subtotals/total)

θθθθθ   DD.   Use Structured Query Language

DD.001   Retrieve data based on conditions
DD.002   Insert data based on conditions
DD.003   Update data based on conditions
DD.004   Delete data based on conditions
DD.005   Create and maintain database objects
DD.006   Control transactions
DD.007   Control data/user access

θθθθθ   EE.   Use Databases in a Web Environment

EE.001   Use an ODBC connection
EE.002   Demonstrate an understanding of URL parameters
EE.003   Insert data from a database into a Web Page

EE.004   Insert data into a database from a Web Page form
EE.005   Maintain data in a database from a Web Environment

COMPUTER PROGRAMMING
Aligned with Vermont Standards: 1.21, 1.22, 2.10, 2.11, 2.12, 2.13, 2.14, 7.17

θθθθθ   FF.   Program Design: Algorithm and Code Development
FF.001   Provide an overview of the problem to be solved
FF.002   Break down the task into its functional components (i.e., the methods that will be used to solve the problem)
FF.003   Design program logic using both graphical and pseudocode techniques
FF.004   Describe the fundamental data types in your plan and their definitions
FF.005   Translate data structures and program design into code in a programming language
FF.006   Develop algorithms and read algorithms developed by others
FF.007   Compare and contrast various algorithmic solutions to a problem identifying the pros and cons to each
FF.008   Complete a desk check of an algorithm to test its viability

θθθθθ   GG.   Documentation: Demonstrate knowledge of technical documentation associate with software development
GG.001   Document program specifications
GG.002   Identify constraints
GG.003   Identify input and output (I/O) requirements
GG.004   Write programs that include comments, tabs, white space, and variable naming conventions that allow for self-documenting code
GG.005   Write useful user documentation that describes the program and its limitations, and allows the user to run the program and resolve common problems.

θθθθθ   HH.   Develop Structured Computer Programs in Accordance with Programming Theory
HH.001   Demonstrate knowledge of a variety of keywords and commands
HH.002   Save and load programs
HH.003   Utilize the compile, edit, and debug features of the compiler
HH.004   Demonstrate the ability to use standard data types, constants and variables
HH.005   Demonstrate an understanding and handling of string data
HH.006   Design and write interactive programs controlling screen input/output
HH.007   Use appropriate error trapping
HH.008   Understand and use the formatting features of the language
HH.009   Demonstrate use of decision and selection structures
HH.010   Demonstrate knowledge and use of math operators and order of operations precedence
HH.011   Demonstrate knowledge and use of relational and logical operators
HH.012   Use counters and accumulators to produce summary information
HH.013   Use menus and procedures/functions to control flow of complex programs
HH.014   Demonstrate knowledge of one and two-dimension arrays
HH.015   Demonstrate knowledge and use of pre-defined and user-defined functions
HH.016   Demonstrate an understanding of parameter passing
HH.017   Use sorting effectively in a program
HH.018   Use searching effectively in a program
HH.019   Develop and use data files

θθθθθ   II.   Incorporate Testing in Programs
II.001   Write programs that handle solvable run-time errors such as data entry errors, file-not-found, divide by zero, etc.
II.002   Correct syntax and lexical errors allowing programs to compile
II.003   Correct common run-time errors
II.004   Create test data and plan for checking logic and error routines
II.005   Execute programs with test data
II.006   Analyze test results
II.007   Correct logic errors

II.008   Retest programs

II.009   Thoroughly test programs to make sure they follow specifications, and that all sources of possible error are handled appropriately

VERMONT FRAMEWORK OF STANDARDS AND LEARNING OPPORTUNITES
CROSSWALK (INFORMATION TECHNOLOGY PROGRAM CLUSTER COMPETENCIES)

Fields of Knowledge Area	VT Framework Academic Standard Addressed	Program Core Competency Crosses all Programs	PROGRAMMING Concentration Competency	NETWORK MANAGEMENT Concentration Competency	INTERACTIVE MEDIA Concentration Competency	INFORMATION SUPPORT AND MAINTENANCE Concentration Competency
Science, Mathematics, and Technology	7.2 aa.-ff.– Inquiry, Experiment and Theory - design and conduct investigations and projects.	D, E, F		C,D,E,F		
	7.3 aaa. – Inquiry, Experiment and Theory - understand the nature of mathematical, scientific, and technological theory.	D, E, F		C,D,E,F,G,H		G-J
	7.11 aaa., bbb. - Systems - collections of interrelated parts and interconnected systems.	A, B, C		Y,Z,AA,AB		A-F
	7.12 f., ee.,ff., fff.– Space, Time and Matter - understand forces and motion, the properties and composition of matter, and energy sources and transformations.			V,W,Y,Z,AA,AB		A-F
	7.17 bb., dd., ddd. - Design and Technology – technological systems.	A - G	B,C,D	A-W,Y-AB	A-Z,AB	A-Q,U-X
	7.18 bb., bbb.– Design and Technology - outputs and impacts of technology.	A, B, C, G,		Y-AB	N,OR,S,T	
	7.19 aaa., bbb.– Design and Technology - processes to design solutions to problems.		H	Y-AB	U,V,AB	

Vital Results	VT Framework Standard Addressed	Program Core Competency Crosses all Programs	PROGRAMMING Concentration Competency	NETWORK MANAGEMENT Concentration Competency	INTERACTIVE MEDIA Concentration Competency	INFORMATION SUPPORT AND MAINTENANCE Concentration Competency
Communication	1.8 j., k.– organize and convey information and ideas written reports.	H,I	F		R,S,T	
	1.10 cc.– organize and relate a series of steps in written procedures.	H,I	F		R,S,T	
	1.13 a.-c. – listen and respond to communications.	H,I	C,F	C,D,E,F,X		
	1.14 a.-e. - critique what they have heard.	D,E,F,H,I	F	X		A-F
	1.15 a.-g. – verbal and nonverbal skills to express themselves effectively.	H,I				
	1.17 aaa. – interpret and communicate using mathematical, scientific, and technological notation and representation.	H,I	F	X	F,G,H,I,J,K,L	
	1.18 – computers, telecommunications to research.	A-I		C,D,E,F	R,S,T	A-F
	1.19 –organizational systems.	D,E,F,H,I	C	C,D,E,F	R,S,T	A-F
	1.20 – graphs, charts to communicate.	H,I		X		
	1.21 – technologies and applications to solve problems.	H,I	A,B,C,E	A,B,I,J,K,L,M,T,U,V,W	A-Z, AB	A-F,K-X
	1.22 – simulate and model	H,I				R-X
Reasoning and Problem Solving	2.2 aa.-ee. – reasoning strategies, knowledge, and common sense to solve complex problems.	D,E,F	A,B,C,E,G	C,D,E,F,X	U,V,AA	
	2.3 aa., aaa., c. – solve problems of increasing complexity.		D	X		
	2.4 a.-f. – effectiveness of a		A,B,C,D,E,G		A-E, U,V,AA,AB	

	system.					
	2.10 – generate several ideas using a variety of approaches.		C,D,E	A,B,I,J,K,L,MT,U	A-E,P,Q,AB	K-Q,U-X
	2.11 - represent in detailed form.		D,F			U-X
	2.12 – modify or change their original ideas to generate innovative solutions.		D,G		R,S,AA	U-X
	2.13 – design a product, project, or service.		B,D,E,H		R,S,U,V,AB	G-J,U-X
	2.14 – plan and organize an activity.		B,C,E	A,B,I,J,K,L,M,T,U,X	A,B,P,Q,R,S,T,U,V,AB	K-Q,U-X
Personal Development	3.3 – demonstrate respect.					
	3.10 – perform effectively on teams.	K				
	3.11 – interact respectively with others.	K				
	3.12 –systemic and collaborative problem-solving processes.	K				
	3.13 – roles and responsibilities in their family, their school, and their community.	K				
	3.14 dd. - demonstrate dependability, productivity, and initiative.	K				
	3.15 aaa. - Students know about various careers.	K				
	3.16 – transition planning	K				
Civic / Social Responsibility	4.3 – understanding of cultural expressions.	J				
	4.4 – understanding of the concept of prejudice.	J				